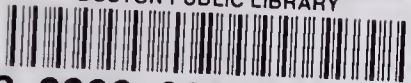


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A REPORT ON THE
INCIDENTS OF FIRE VICTIMS AND PROPERTY DAMAGE
IN THE
CITY OF BOSTON

PREPARED BY
THE BOARD'S COMMITTEE ON FIRE
INSURANCE RATES

WITH THE ASSISTANCE OF
WILLIAM F. CANN ENGINEER
HARVARD UNIVERSITY

MILITARY ENGINEERING DEPT.

AND

THE BOARD OF FIRE INSURANCE RATES
BOSTON FIRE INSURANCE ASSOCIATION
BOSTON, MASS.

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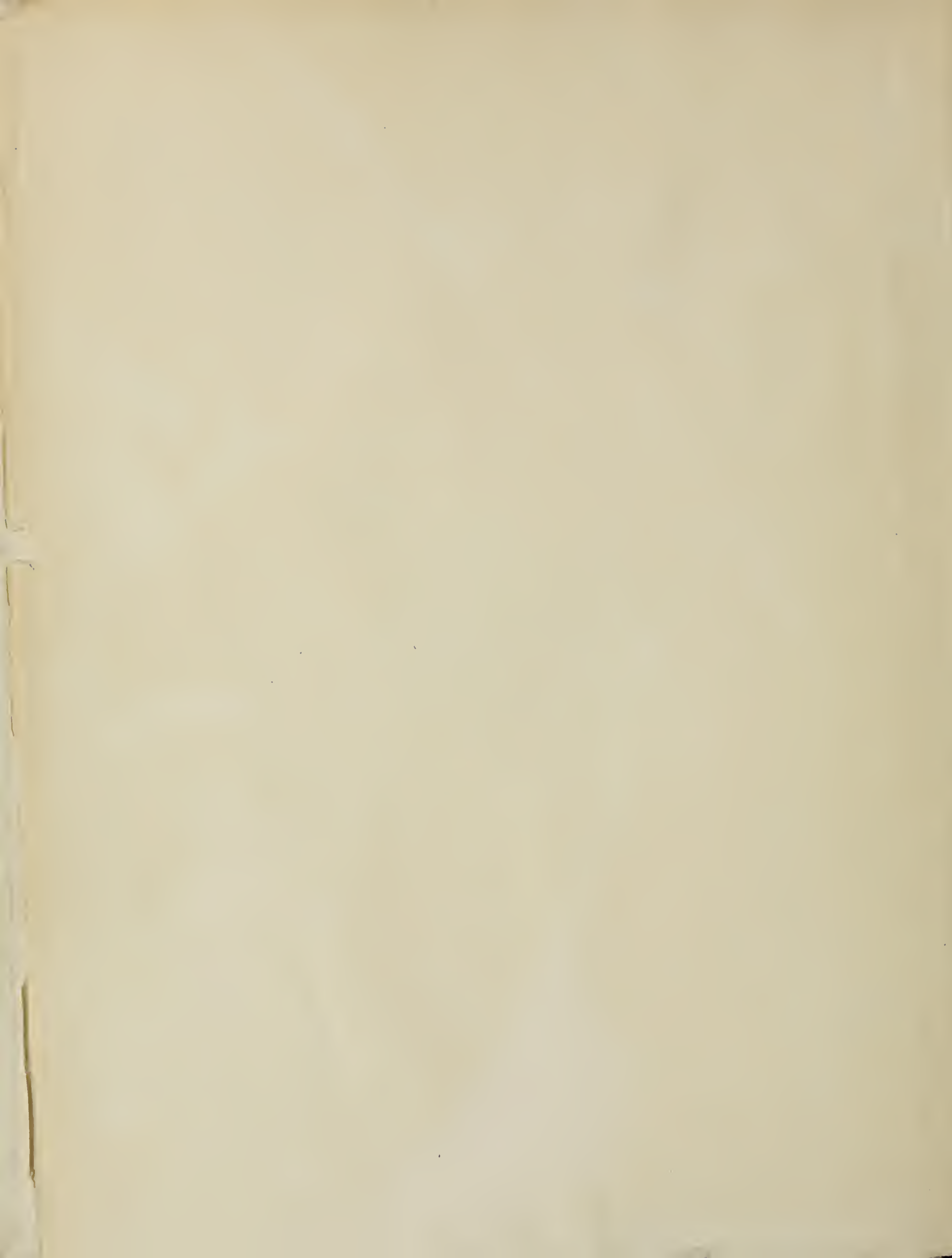


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CITY OF BOSTON
1929



MALCOLM E. NICHOLS
MAYOR

A REPORT ON THE
**PROBLEM OF FIRE WASTE AND
INSURANCE RATES**

IN THE
CITY OF BOSTON

Prepared by

THE MAYOR'S COMMITTEE ON FIRE INSURANCE RATES

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ELWYN G. PRESTON

LOUIS K. ROURKE

¹ Deceased.

~~213~~
Dec. 1, 1930
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CITY OF BOSTON IN CITY COUNCIL

Ordered, That the Superintendent of Printing be hereby authorized to print an edition of 500 copies of the Fire Insurance Rates report and that the expense of the same be charged to the appropriation for city documents.

Further Ordered, That this edition shall be distributed under the direction of the City Messenger, and that any income received through such distribution be credited to the appropriation mentioned above.

In City Council, September 9, 1929. Passed.

Approved by the Mayor, September 16, 1929.

Attest:

(Signed) JOHN B. HYNES,
Assistant City Clerk.



MALCOLM E. NICHOLS
MAYOR

CITY OF BOSTON
Mayor's Committee on Fire Insurance Rates
CITY HALL

FELIX VORENBERG
CHAIRMAN
WILLIAM A. FISHER
SECRETARY
TELEPHONE HUBBARD 5100

DECEMBER 10, 1929.

HON. MALCOLM E. NICHOLS,
Mayor of the City of Boston.

DEAR SIR:

The undersigned Committee was appointed by Your Honor to study and report upon the general situation in this city in regard to fire insurance rates. In accordance with your instructions the Committee has made an investigation intended to cover all aspects of the Boston fire problem which affect insurance rates, and the attached report is submitted for your consideration and such action as you may deem desirable.

For the purpose of obtaining data and information upon which to base our report we employed Miller McClintock, Director of the Albert Russel Erskine Bureau of Harvard University, who had the active assistance of Horatio Bond, of the Field Engineering Department of the National Fire Protection Association. In addition to the data and information supplied by these agencies your Committee received the hearty cooperation of the heads of city departments who had any information which could be of value in preparing this report.

We trust that your Committee will have been of service to the city, making available information which if properly applied will result in reducing the fire waste in the City of Boston.

Respectfully,

Chairman.

MAYOR'S COMMITTEE ON FIRE INSURANCE RATES

TECHNICAL STAFF

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HORATIO BOND, Field Engineering Department,
National Fire Protection Association *Chief Engineer*
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PART I

GENERAL REVIEW AND RECOMMENDATIONS

This survey of Boston's fire hazards and resources of fire defense furnishes the basis for consideration of the inquiry as to the reasonableness of the financial burdens the city is carrying in one way or another to protect the lives and property of her citizens from destruction by fire and the economic results of such destruction.

Disregarding for the moment the huge sums spent for fire extinguishing agencies which are supplied by taxation and do not therefore register directly in the consciousness of the average citizen, it is obvious that in the last analysis the amounts he pays for indemnity through fire insurance must have a fundamental relation to the losses which fire prevention or extinguishing agencies do not prevent. In other words, there must be paid in premiums enough to cover the insured losses plus the profits and operating expenses of the insurance companies underwriting the risks. The act of drawing a check in payment of insurance premiums forcefully registers this item in the mind and gives to it an importance greater than that commonly given to the other economic elements of the fire waste. In fact to many people fire loss and fire insurance appear to be the same thing. The result is their indifference to fire prevention; they are ordinarily willing to leave to the insurance companies what appears to be their affair.

This leads at once to the subject of fire insurance premium rates whenever the matter of fire prevention is projected.

Part II of this report is devoted to an examination of available data concerning fire insurance rates in Boston and their relation to fire hazards and losses. It will be noted that in a representative year, 1927, Boston property owners paid insurance premiums of approximately \$9,000,000. This is undoubtedly a large sum, and a major item of the financial burden of Boston's fire protection but this study shows that the insurance companies are collecting no more from Boston in proportion to its fire losses than from other sections of the country. It will be noted that Boston has nearly twice the annual fire loss of Baltimore, a city of about the same population, and about the same annual losses as Philadelphia and Detroit, cities more than twice her size. (Part III, Chapter 3.)

In Part II will be found minor suggestions for the improvement of present rating practices in the direction of equalization. It is felt that the Boston Board of Fire Underwriters attempts fairly to apportion the aggregate premiums among the various classes but lacks the necessary experience data to provide complete

equity in this distribution. The average fire losses paid during the past five years (1923-1927) in Boston have accounted for about 54 per cent. of the premiums collected. It is asserted that under present conditions the insurance companies' expenses run generally to about 45 per cent. of the premiums. This report offers no opinion upon the justifiability of this expense ratio which includes the cost of rendering organized engineering and inspection service, the maintenance of salvage corps (Chapter 8), and considerable other service to the public, including the payment of taxes.

As is elsewhere indicated it is quite possible to reduce the fire losses in Boston by half. If losses were so reduced and such reduction sustained a reduction of rates would reasonably follow. Other cities have secured such reductions. Under the present improved administration of the Fire Department, Boston's insured fire losses have already been reduced from the 1918-1927 average of \$5,000,000 annually to \$3,700,000 in 1927 and \$3,500,000 in 1928. Insurance rates are not alone based, however, on the loss experience of a single city but secondarily upon that of the state and nation. Boston's high loss ratio has been exceeded generally throughout the state. It is for this reason that projects for cooperation in fire waste reduction in Boston's surrounding territory and the state are included in this report. (Chapters 2, 8, 16.)

The major part of this survey is devoted to an analysis of conditions involving fire hazards in Boston and the agencies of fire prevention and defense. Its conclusions are based upon careful study and its recommendations are the result of mature deliberation after conferences with the various city and state departments affected. Where fire records were available for analysis they have served as the basis for the conclusions and recommendations. It will appear that the outstanding factors in Boston's bad record are poor building construction,¹ limitations of the personnel of the Fire Department, ineffectiveness of the State Department of Public Safety, and individual negligence by property owners. The factors of water supply (Chapter 9), fire alarm service (Chapter 9), fire apparatus and size of the fire fighting force are reasonably adequate.

Boston has already paid and may yet pay dearly for the character of her buildings housing valuable stocks in the business portions of the city. Brick-walled buildings with wooden interiors are essentially furnaces with the doors and windows potential draft openings. Much, however, can be done to safeguard these interiors by the installation of automatic sprinklers, and by closing up or protecting unnecessary vertical and horizontal openings through which fire may spread. The cost of safeguarding these mercantile buildings now such a menace with their possibilities of heavy losses from sweeping fires, is negligible considering the results in safety that would accrue to the city and individual owners. This report shows that most Boston dwellings have similar defects and indicates that the

¹ Particularly the lack of protection to vertical openings in buildings.

serious fires occurring in apartment houses have been due to the spread of flames through unfirestopped interior walls and up unprotected stairways and unenclosed vertical shafts. (Chapter 4.)

The revelations concerning the Boston building code, the influence of which in its present form is calculated to discourage a progressive improvement in construction and stimulate the erection of the types now responsible for the city's bad fire record, are disconcerting. There is practically no incentive under the code to erect good buildings. It is possible its need of recodification since it was first drafted in 1907 is partly responsible for its having so long escaped the scrutiny of public-spirited men interested in keeping Boston in step with the improved building construction of the age. No time should be lost in revising, rewriting and bringing up to date this fundamental vehicle of the city's physical progress. (Chapter 2.)

Next to that of building construction the Fire Department is the most important factor in Boston's fire loss record. As the improved efficiency of this department in the last few years has been to a considerable extent responsible for the material reduction of the 1927 and 1928 losses, so its deficiencies in other years have helped to establish Boston's deplorable record. The instability of the office of Fire Commissioner has made and will continue to make under present conditions a political football of this position which is of such paramount importance to the well-being of the city. Boston's fire department in years past has invited political interference and its frequent shift of commissioners has prevented the development of fixed policies, with inefficiency and low morale as the result. Boston has few public offices with which it is more unwise to trifle and for which she has unwittingly paid so heavily in actual cash as the price of her civic neglect. Aside from this major item, the recommendations for the improvement of the department should not be difficult of attainment. They are such as any business organization with efficiency as its goal would demand as a matter of course. Because of the unwise entrance requirements the Fire Department is not attracting the highest grade of personnel, and adequate retirement provisions are lacking. The best men in the department are held to the level of the poorest. Systematic education and training of officers and men can no longer be ignored by a modern department. (Chapter 7.) The suggestion for the establishment of a technical division is believed to warrant especial consideration as containing potentialities for rapidly making Boston's department one of the best in the country.

The matter of reducing the number of Fire Department runs is discussed in Chapter 5, and in Chapter 8 is given a proposed set of traffic regulations designed to apply to certain streets used habitually by the department in responding to fires.

Fire departments generally are evolving out of mere water-throwing agencies into fire prevention organizations whose successes are registered before the

fires occur. It is believed that the modern fireman should not be kept continuously inactive in the fire houses only to go out and endanger life or limb in fires which should not be permitted to occur. A much more intelligent disposition of energy and knowledge is now generally being made in inspection work and investigations of fire causes by the uniformed forces, and in the further study of fire hazard conditions in the light of such investigations. The discouragement and detection of the crime of arson is closely related to this work (Chapter 11) and the value of the proposed technical division (Chapters 7, 11) in furnishing an adequate basis for the intelligent study of fires, fire hazards and their safeguarding is obvious. There has developed a confused relation between the Boston Fire Department and the State Department of Public Safety the long continuance of which reflects no credit upon the state authorities and has continuously resulted in impairing the efficiency and morale of the Fire Department's inspection service. (Chapter 14.) A competent revision of the state laws which now so unhappily divide responsibility and hamper effective action in safeguarding the city should be no longer delayed.

The chapters of this report outlining the fire problems of Greater Boston and suggesting possibilities of fire department mutual aid (Chapter 8), the plan for a state-wide attack upon the fire waste (Chapter 16) and the suggested responsibilities of individual property owners (Chapter 9) are important for completion of the picture of Boston's fire safety and what may be necessary to insure and maintain it.

In the various sections of this survey so briefly outlined above and in the appendices to the same are assembled detailed statistical tables, charts, analyses of facts, and specific recommendations based upon engineering experience and judgment which must be observed if the present indefensible economic drain upon Boston's physical resources is to be checked. This investigation and report is believed to be the first of its kind ever undertaken by an American municipality, and while Boston's tardy recognition of the serious fire conditions which confront her may be matter for remark it may be surmised that most other cities if subjected to so comprehensive a survey would reveal similar imperative need for improvement. America is not yet awakened to the serious economic significance of the fire waste, and until the present active forces of fire prevention education are successful in registering their objectives our cities will continue to be drained of their resources by an easily preventable waste and occasionally be decimated by sweeping fires of considerable magnitude.

Adoption of many of the recommendations in this survey can be accomplished without the expenditure of any great sums of money. They involve only the revision and modernization of methods of routine which are outgrown and do not meet present needs. Now that this inquiry has been undertaken and the facts so clearly established, it would seem to require only the persistent

interested action of a group of influential citizens working in cooperation with the Mayor and the Fire Commissioner to promote conditions that will be of immediate economic value in reducing Boston's unconscionable annual fire toll and will safeguard the city's future against disaster. In the realm of civic action as well as in the domain of science, desire precedes functioning.

RECOMMENDATIONS

GENERAL

1. That the engineering conclusions in the technical sections of this report applying both to the City of Boston and the State of Massachusetts be carefully considered and applied by the proper agencies in order that the preventable fires in the city and state may be rapidly reduced and eventually largely eliminated. That a continuance of the good fire record of 1927 and 1928 in Boston should result in a reduction of fire insurance rates, properly distributed over the whole city.

FIRE INSURANCE RATES

2. **Class Experience.** That the Boston Board of Fire Underwriters obtain from their companies figures which show losses, premiums and amount at risk for all important classes of property, for Boston and for the country at large, in order to more equitably adjust rates on specific classes.

3. **"Short Schedule" Rate.** That the Boston Board of Fire Underwriters justify the 25 cent base rate for the "short schedule" in Hyde Park, or reduce it to the 20 cent figure applying in the rest of the city.¹

4. **Flat Rates.** That the minimum flat rates on dwellings and apartments be justified by experience data furnished the Boston Board of Fire Underwriters by their companies.

THE FIRE WASTE

BUILDING CONSTRUCTION

5. **Revision of Building Code.** That the Boston building code be revised. That special attention be given to all matters noted in Chapter 2, including the following major items: (Chapters 2 and 10.)

(a) Arrangement of the code in logical sequence for the convenience of those governed by it.

(b) Reduction of the permissible height of frame and unprotected wood-interior dwellings.

¹Since this report was drafted, the Boston Board, as a result of this recommendation, has reduced the "short schedule" base rate in Hyde Park to 20 cents.

(c) Provision for an intermediate type of light fire-resistive construction for appropriate occupancies.

(d) Inclusion of more definite egress requirements for all types of buildings.

6. Inspection of Old Buildings. That a portion of the staff of the City Building Department be regularly assigned to the inspection of old buildings, and that reduction of fire hazards be secured as far as possible under the discretionary powers of the Building Commissioner. (Chapter 12.)

7. Survey of City Buildings. That the city authorize a complete survey of all city-owned buildings, especially hospitals, schools and other buildings used as places of assembly, to develop a plan for correcting the faults which exist in many of them, which in case of fire would involve hazard to life. (Chapter 1.)

THE FIRE DEPARTMENT

8. Fire Commissioner. That the Fire Commissioner be a capable and qualified person, preferably an engineer, that he be allowed to administer his office without political interference and that it be an established city policy that qualified incumbents of this office be not replaced because of changes in city administration.

9 Personnel. That the maximum age limit for admission to the Fire Department be reduced to 25 years.

10. That the physical and mental examinations for admission to and promotion in the Fire Department be made more stringent, with especial reference to the following items:

(a) Examination of applicants in rudimentary engineering subjects.

(b) Questions for applicants which will indicate their relative intelligence regardless of their formal education.

(c) Physical examinations varied in severity according to the rank to be filled.

11. That men be admitted to the Fire Department for a definite period of enlistment at the end of which they may be retired if incompetent, regardless of age or physical condition.

12. That age-limits for compulsory retirement of members of the Fire Department be established, graduated according to the rank held, privates, for example, to be retired at a relatively early age, and appropriate limits set for the other ranks, the maximum limit for chief of department being set at 62 years.

13. Technical Division. That a Technical Division be established in the Fire Department under a superintendent having a technical education, experienced in fire protection engineering. That he be assisted by a staff of at least 5 junior engineers who shall receive salaries comparable to those of captains or lieutenants. That this division study the technical aspects of fires, maintain and analyze fire records, and on the basis of the study of these records, plan inspection work, develop new fire fighting and fire control methods, and conduct the necessary research to intelligently project the future development of the department; also instruct the junior officers of the Fire Department in technical matters and supervise the highly technical work of inspection and control of the special fire hazards of explosives and flammables. (Chapters 7, 11 and 12.)

14. Drills and Training. (a) That a drill school for the continuous training of all men in the Fire Department be established.

(b) That this be in addition to the training of probationers and in addition to company drills and inspections.

(c) That a "fire college" or officers' school be established.

(d) That the proposed Technical Division plan courses of instruction for officers in technical subjects such as building construction, special fire hazards and fire protection.

(e) That in connection with the officers' school, regular officers' conferences be developed under the direction of the chief officers of the department, to provide for continuous exchange of ideas on administration, maintenance of discipline, fire methods and similar appropriate topics.

15. Salvaging Operations. (a) That the Fire Department actively participate in salvaging operations in cooperation with the Boston Protective Department.

(b) That the Fire Department drill school include instruction in salvaging operations.

(c) That salvage equipment (covers and tools) be carried by ladder companies in East Boston, Hyde Park, Brighton, West Roxbury and Dorchester, and that the Fire Department perform salvage work in all districts of the city to which regular response of the protective companies is not practicable.

(d) That the firemen assist the Protective Department in clearing water from floors and basements, in cleaning up, and in other salvage operations when their fire duties permit.

16. Response of Fire Apparatus. (a) That box-alarm apparatus be assigned to all still (telephone), automatic and sprinkler

supervisory alarms 24 hours a day, or at least between the hours of 5 p. m. and 8 a. m., and 24 hours on Sundays and holidays.

(b) That the Fire Department as well as the Protective Department respond to water flow alarms on sprinkler systems.

17. To Reduce Number of Alarms. That a brush and grass fire patrol be established to operate in the areas where such fires are frequent and during the dry periods of the year. (See Chapter 5.)

18. That the recommendations of Chapter 5 for reducing the number of false alarms be carried out by the Fire and Police Departments.

19. Distribution of Men and Apparatus. That a thorough study be made of the distribution of fire stations and fire apparatus to be used as a basis for planning the future development of the department.

NOTE: This study can be performed by the proposed Technical Division. Otherwise a sum of money should be appropriated in order that a competent engineer may be retained to make the study.

20. Maintenance Division. That the present maintenance shop, the Wareham Garage and the fire alarm repair department be consolidated.

21. That the Fire Department equip each company with a small supply of $1\frac{1}{2}$ inch hose with $\frac{1}{2}$ inch nozzles for use on the small standpipes now in old buildings. (See also Recommendation 37.)

22. Arson Squad. That the police officer and fire inspector now available be officially constituted an arson squad.

23. Inspection by Fire Department Officers. (a) That district chiefs and company officers continue to make regular inspections of their districts as at present.

(b) That district chiefs keep records of inspections in such form as to be readily accessible covering the essential features of the more important buildings in their districts, including such matters as special fire hazards of occupancy, location of stairs, elevators and other openings, peculiar characteristics of construction, operating condition of sprinkler and standpipe systems and other information which would be of value in case of fire.

(c) That training for district chiefs and company officers be provided in the "fire college" covering inspection procedure, fire hazards and other items given inspectors of the fire prevention division, and that hereafter, every private, before promotion to lieutenant, be required to serve at least a year as an inspector in the fire prevention division.

24. Inspection by the Fire Prevention Division of the Fire Department. (a) That 30 additional inspectors be added to the present staff of the fire prevention division.

(b) That of the staff of 54 inspectors thus formed, 42 be assigned to "inspection patrol," to critically inspect the buildings in the districts illustrated in Figs. 209 and 211 (Chapter 12).

(c) That these men inspect every building in the designated inspection areas not less than once a month and preferably once every two weeks.

(d) That these inspectors be rotated from district to district.

(e) That the remaining 12 inspectors systematically cover the parts of the city not included in the special inspection areas after the manner now followed by inspecting each fire district in sequence until the entire city has been covered.

(f) That the proposed technical division when created provide a staff of at least two men who can devote their entire time to inspections of special hazards and to supervising such inspection of special hazards as may be delegated to the regular inspection force.

25. Wire Division. That a systematic reinspection of old electric wiring be made so that all defects may be corrected, and all wiring be subsequently reinspected at suitable intervals.

26. Inspection Conferences. That the fire department sponsor a meeting of the heads of the various inspection agencies at least four times a year, to coordinate inspection work in the city, develop cooperative action and make possible a concerted attack on particular fire hazards from time to time as may seem desirable.

OTHER PUBLIC FIRE PROTECTION

27. Water Supply. That the recommendations regarding the Boston Water Supply System in Report No. 158 of the National Board of Fire Underwriters, October, 1925, so far as they have not already been acted on, be carried out.

28. Fire Alarm System. That the recommendations regarding the Boston fire alarm system in the special report of the National Board of Fire Underwriters of March, 1926, supplement to Report No. 158, so far as they have not already been acted on, be carried out.

29. That a special appropriation be made each year for the fire alarm system in order that it may not fall below its present high standard, and with particular reference to the following items:

(a) To provide a definite number of new boxes and circuits each year in newly built sections of the city.

(b) To replace a given number of fire alarm boxes of inferior types with modern boxes each year.

(c) To provide adequate lighting for a given number of boxes each year.

(d) To provide a bell or other alarm signal that operates at the box only when the box is pulled, in order to discourage false alarms. (Chapters 5 and 9.)

TRAFFIC

30. (a) That the plan of traffic control and congestion relief proposed by the Mayor's Street Traffic Survey be applied in its entirety; that projects for a more adequate street system in the congested districts be brought to realization as soon as possible; and that the traffic commission continue to conduct investigations of troublesome traffic conditions and recommend rules and methods for their amendment.

(b) That very narrow streets habitually used by fire and protective departments in responding to fires be designated as fire routes on which no automobiles or other vehicle shall be parked on either side at any hour of any day except as necessary for the loading or unloading of goods and passengers.

(c) That parking of vehicles be prohibited at all points where fire exits may be blocked or sprinkler or standpipe connections made inaccessible.

AUTOMATIC SPRINKLERS AND PRIVATE FIRE PROTECTION

(Matters covered by Law or Regulation)

31. That the proposed revision of the building code include adequate provision for private fire protection in both new and old buildings especially respecting automatic sprinklers and standpipes.

32. That the State Fire Marshal, in compliance with Section 39M of Chapter 148, General Laws, define the classes of buildings to be equipped with automatic sprinklers in accordance with Section 36, of Chapter 148, General Laws, with special attention to occupancies such as tenant mercantile and manufacturing, and retail stores.

33. That suitable regulations for the installation of automatic sprinklers be issued by the State Department of Public Safety.

34. That the provision of Section 41 of Chapter 148, General Laws, which states that no rule or order (of the State Fire Marshal) shall be made or enforced which requires an expenditure by the owner or occupant of more than 5 per cent. of the assessed valuation of the premises involved, be modified. (Under this present provision, it is frequently impossible for the marshal to require automatic sprinkler installations in certain hazardous occupancies as provided in Section 36 of Chapter 148, because the cost of sprinklers is more than 5 per cent.)

AUTOMATIC SPRINKLERS AND PRIVATE FIRE PROTECTION

(Matters which are the Responsibility of the Individual Owner.)

35. "Conflagration Breeders." That owners of buildings which, by reason of their size, construction or occupancy, single or combined, might act as "conflagration breeders" completely equip their property with automatic sprinkler systems. (Chapter 1, Chapter 9 and Appendix 1.)

36. Other Buildings Which Should Be Sprinklered. That automatic sprinkler equipments be installed in all mercantile, industrial and apartment buildings, especially the following:

(a) Those which contain high values or are in any way hazardous regardless of whether they are a menace to surrounding property or not.

(b) Those in which lives are endangered due to construction or occupancy.

37. Standpipes. (a) That owners of buildings provide standard 2½-inch outlets on all old standpipes with risers 3 inches or larger, and standard 1½-inch outlets on all old standpipes less than 3 inches. (See also Recommendation 21.)

(b) That buildings erected prior to the application of the standpipe law of 1923 be conspicuously labelled on the outside of the building near doors, giving the size of standpipe riser and size of hose outlets.

38. Private Fire Alarms. (a) That owners of buildings equipped with automatic sprinklers provide either sprinkler supervisory fire alarm service or some type of supervised private fire alarm service to facilitate prompt discovery of the fire and to prevent unnecessary water damage.

(b) That owners not installing automatic sprinklers in their property provide some form of supervised automatic fire alarm service. (This applies particularly to properties which house valuable or irreplaceable contents, and large private residences.)

39. Special Hazards. That all especially hazardous substances or manufacturing processes be adequately safeguarded through competent advice obtained from local underwriting organizations by manufacturers and other property owners maintaining such hazards.

OTHER FACTORS INVOLVING INDIVIDUAL RESPONSIBILITY

40. That individual property owners study their buildings to see if defects of construction can be corrected or if automatic sprinklers or other fire protection might be profitably installed.

41. That owners of private hospitals, private schools, and other private buildings used for places of assembly provide a check-up on their property to correct features involving hazard to life in case of fire. (Chapter 1.)

42. That property owners maintain good housekeeping conditions around buildings or premises to eliminate accumulations of rubbish and other combustible materials.

43. That owners of dumps provide suitable supervision of these so that the fire department may not be needlessly and repeatedly called to fires in them.

44. That owners of vacant lots keep them clean of rubbish and tall grass.

LAWS AND REGULATIONS

45. **State Fire Prevention Laws.** That Chapter 148, General Laws, be completely revised, especially with regard to the following:

(a) Placing the responsibility for fire prevention inspection (and in Boston, the investigation of fires) directly on the local fire departments, and giving them adequate authority to do this work. (Chapters 11, 12 and 14.)

(b) Revising the procedure for licensing and the issuance of permits for occupancies involving fire hazards. (Chapter 14.)

46. **Regulations.** That the fire marshal under authority of existing laws provide adequate regulations on fire hazards and fire protection with particular attention to the following matters:

(a) The revision of existing regulations to conform with best current practice.

(b) The drafting of new regulations on subjects not now covered but where there is legal authority for them.

(c) The elimination of all unnecessarily drastic provisions of the regulations in the interest of securing a body of rules which would be generally recognized as reasonable and proper and which therefore may be more readily enforced.

47. **Arson Laws.** That the arson laws (Chapter 266 of General Laws, Sections 1-10) be revised and brought into conformance with the Model Arson Law (Chapter 11).

48. **Law Department.** That the Law Department in accordance with the principles outlined in this report prepare suitable bills to carry out the various recommendations made herein. (Chapter 15.)

METROPOLITAN PROBLEMS

49. Uniform Building Regulations. That an unpaid commission be appointed by the governor to study the facilities for supervision of building construction in the 40 cities and towns of Greater Boston with the idea of suggesting a plan for uniform regulations and centralized enforcement. (Chapters 2 and 12.) That the work of this commission cover the following principal subjects:

- (a) Uniformity of major provisions of building codes.
- (b) Relative value of each code as compared to modern standards.
- (c) Facilities for enforcement (building department staffs).
- (d) Qualifications of building officials.
- (e) Work of the Division of Inspections of the state Department of Public Safety and the state building laws under which that division operates.

50. Mutual Aid. That an unpaid commission be authorized by the General Court to study the feasibility of a definite mutual aid system among the fire departments in the cities and towns of Greater Boston and to recommend machinery to bring this about. (Chapter 8.)

STATE MATTERS

51. Department of Public Safety. That a competent person be appointed State Fire Marshal, preferably a man with technical education and experience.

52. (a) That the Commissioner of Public Safety as provided by Chapter 148, General Laws, designate the members of the Boston "Arson Squad" as fire investigators.

(b) That such state investigators as are now operating in Boston and may not be needed be released for fire prevention work elsewhere in the state.

53. That the State Fire Marshal and his assistants cooperate closely with the fire prevention division of the fire department, providing that division with information concerning state laws and regulations.

54. That in such matters as must be handled by the state authorities, the fire marshal's department expedite action to the end that enforcement of laws, regulations and orders may be prompt and effective.

EDUCATIONAL WORK

55. That civic and trade organizations sponsor educational work in fire prevention directed both to their own members and to the public at large.

PART II

FIRE INSURANCE RATES IN BOSTON

The purpose of this report is to determine the basis for fire insurance rates in the City of Boston. A brief statement of the fundamentals of fire insurance rating is necessary for a clear understanding of the problem.

EARLY HISTORY

In the early days of the fire insurance business, buildings only were accepted as a fire risk. The fire hazards of occupancy were little apparent to the insurer, and he concerned himself only with the class of construction. Buildings were either brick, stone, or frame, and, for evident reasons, the risk to the insurance company varied according to construction. Rates on wooden buildings were about double those applying to brick ones, and all buildings in each class were written at one rate.

Gradually, commercial and industrial activity increased; new hazards of occupancy came into the field; power hazards were introduced; and insurance coverage was extended to contents as well as to buildings. As a result, a more complicated method for the selection of fire risks came into use, known as the "group system."

Buildings were divided into three classes according to the occupancy. Such classes were designated as "non-hazardous," "hazardous," and "extra hazardous." This was the beginning of the complicated rating system of today, whereby selection of risks, and the corresponding rates applying, are governed by details of construction, hazards of occupancy, exposure, protection, and many other factors.

MODERN INSURANCE RATING — GENERAL THEORY

Insurance always is, and has been, the dispersion of the effect of destruction; the distribution of loss over a wide area and among many people, and consequently a distribution of the cost of insurance among a great many people. The budget which the insurance companies must necessarily raise, consists of the value of property destroyed by fire plus the expense of doing business, plus a reasonable profit. The cost of doing business is relatively fixed. It may vary during certain periods, and in different territories, but such variance can be determined readily.

The value of insured property destroyed by fire is more variable. The fire loss is influenced by certain known factors, and likewise by intangible factors

such as the characteristics of people and business conditions. In addition weight must be given to unpredictable circumstances, such as earthquakes and conflagrations, which can be determined only by averaging experience over many years. It is apparent that the problem of determining rates is one of great complexity and is to be understood only by a consideration of the detailed factors which compose the rating technique.

Complex as the problem is, there is no "mystery" surrounding its solution. It is the result of evolution; a problem with which many generations of brilliant minds have labored, and during all these years, experience has been, and still is, the only sound foundation for rate structures. This evolution may not be complete, in fact it is felt that the so-called "scientific" rating falls short of meriting such a description. The general foundations have been built wisely, but it is believed that further refinement can be obtained. The insurance companies themselves are in the best position to do this if they compile their experience and apply it to making specific rates measure more equitably the hazards of the property.

Measurement of fire hazard is the prime function of insurance rating. The problem then resolves itself into what are fire hazards of any property. Broadly speaking, they are (1) The Element of the Risk Itself, (2) The Element of Place, and (3) The Element of Time.

The Element of the Risk Itself. The basis for the classification of various properties under this heading are: (1) Construction, (2) Occupancy, (3) Exposure, and (4) Protection. Modern rating has produced detailed methods for the differentiation of each of these factors.

Under construction, matters such as materials and design: brick, fire-resistive or frame, the stairway and elevator arrangements, the type of roof, sheathing construction, height of building, skylights, and numerous other features that either retard fire or help to spread it, are considered.

Under fire hazards of occupancy heat, power, light, labor, number of tenants, special fire hazards and their arrangement, and other similar details are considered.

The exposure factor to be considered in any property depends on the likelihood of a fire in an adjacent structure entering through windows or other wall openings, as well as by direct ignition of the building itself.

Under protection, such matters as the efficiency and size of the fire department, fire alarm systems, water supplies, automatic sprinklers, watch service, inside fire protection, are taken into account.

It can be seen that the method of arriving at an insurance rate is necessarily complex because it attempts to recognize the varying degrees of risk in accordance with the variance of the above conditions.

Element of Place. This division of rate-making is probably the least understood. As fire insurance business grew, it became apparent that the fire hazard did not depend solely upon the individual character of the property itself. The ratio of the fire loss to the amount at risk, in different parts of the country varies materially. Fire insurance companies generally use the experience of a given state in fixing premium income, though the fire loss record of the larger cities is also taken into account.

To illustrate: from 1880 to 1915, inclusive, the amount of loss in cents for each \$100 of risk varied in different states as indicated by the following.¹

STATE	LOSSES PER \$100 AT RISK
Connecticut	\$0.44
New Jersey . . . . .	.44
Pennsylvania . . . . .	.53
Massachusetts . . . . .	.60
New York . . . . .	.38

There follows a very important conclusion. *The fundamental basis of stock company insurance is that, as far as possible, the ratio of premium income to the amount of loss must be constant throughout the country for sound operation.*

With the above variation in loss-cost it is apparent that a constant loss ratio can be maintained only by variation of rates in different sections. It is clear, therefore, that a comparison of the rates on similar buildings in two cities, or even in two states, can be, at best, only a very rough comparison. The comparison may mean nothing at all as to the justness of either rate.

All this means is that the general level of rates in any territory depends on the fire loss experience of that territory. This fire loss experience, on which differences in the general level of rates depends, is influenced by construction and occupancy hazards, the generally intangible factor of fire department morale and efficiency, climatic conditions, characteristics of peoples, commercial and economic factors and many other human elements. Even if universal base rates were used as a starting point for various rate schedules, the general level of rates, *i. e.*, an average rate for any given territory, might be widely different, yet both be justified. For example, all other factors being equal, if one state, or city, had five times as many fire resistive buildings as another state, or city, the average rate in the former would be the lower. They would not be comparable, yet both average rates over the whole territory might be justified.

¹See "Measurement of Relative Fire Hazard," J. S. Glidden, Chicago Board of Fire Underwriters. Massachusetts' high loss-cost was chiefly influenced by the Chelsea and Salem conflagrations.

Element of Time. Experience has shown that loss-cost varies from year to year as well as from place to place. The fire loss is not constant from year to year and in some years more insurance is written than in others, so this variance is to be expected. To attempt to adjust rates, in accord with the constantly changing ratio of losses to premiums, would impose additional expense which would ultimately mean increased premiums from the assured. Rates are therefore based on the average experience of a number of years. It is generally conceded that a period of less than five years is of little value as a basis, and some authorities go so far as to claim that nothing short of twenty-five years is adequate.

Conflagrations. The problem of dealing with conflagrations is admittedly one which is beyond scientific treatment. It is a far less serious problem today, with modern fire fighting equipment and improved building construction than it was fifty years ago.

Fire insurance companies have built up reserves from premium income, generally in the form of surplus, to take care of conflagrations and other contingencies. In recent years "underwriting profit" has been small, and has not left much margin for the enlargement of such reserves. Whether there is need of further "underwriting profit" for such unusual contingencies in view of the reserves already accumulated, is a matter of individual company policy.

THE BOSTON RATING PROBLEM

With the preceding general principles in mind attention is now turned to the specific question of the equity of current fire rates in the City of Boston. This subject is treated under the following headings:

1. General Basis for Fire Insurance Rates in the City of Boston.
2. A Study of the Total Premium Contributed by Boston.
3. Specific Rating in Boston.
4. General Fire Insurance Principles Applying Nationally as well as to Boston.
5. Conclusions Regarding Fire Insurance Rates in the City of Boston.

GENERAL BASIS FOR FIRE INSURANCE RATES IN BOSTON

If no state is sufficiently large to carry the cost of its own fire insurance at all times then it naturally follows that no city is sufficiently large to carry its burden of fire cost unaided. California, for example, could never have recovered from the earthquake and fire disaster of 1906, without the aid of the rest of the country. Salem, Chelsea or Fall River, could not have furnished sufficient premium (except over a long period of years) in their respective cities to make it possible for the companies to pay the enormous losses incurred in their conflagrations¹. The State of Massachusetts as a whole, has experienced a poor fire record

¹ Not to mention the \$75,000,000 Boston conflagration of 1872.

over a long period, and this poor record has done much toward keeping rates higher in all the cities throughout the state than would have been the case had the state enjoyed a good fire record. With an improved fire record, lower insurance rates could be expected. For example, the state of Connecticut has enjoyed a good fire record for a number of years and as a result, on January 14, 1929, a state-wide reduction in rates for certain classes of risks was voluntarily put into effect by the insurance companies.

The rate burden, which is placed upon all cities throughout a state, is often severely criticized by some of them, especially those which have experienced good loss ratios. For example, New Bedford spent thousands of dollars improving municipal fire protection and fortunately enjoyed a good loss ratio. Unfortunately, however, just at this period Massachusetts experienced high fire losses, contributed largely by Boston, Lowell, Haverhill, and other cities. These losses had to be distributed over the state and one of two methods was available. Either a flat increase in rates over all property could have been made, or rates increased only on such classes of property as had experienced disproportionate losses.

The latter method was adopted by the Boston Board of Fire Underwriters. When the fire insurance companies asked for more premium from Boston the Boston Board, in July, 1927, increased the rates on those classes of property which had contributed to the heavy losses. This was the sounder of the two methods, and resulted in the burden being placed on the shoulders of those most responsible for the heavy losses. With Boston's own poor fire record as damaging evidence, there was little argument that would justify exempting Boston from such increases.

FIRE INSURANCE ORGANIZATIONS AND TERMS

In the course of this report various insurance organizations are referred to and various insurance terms are used. These are listed below with a brief definition of each.

BOSTON BOARD OF FIRE UNDERWRITERS. This organization is the rate-making body for the City of Boston. Any Boston stock or mutual fire insurance company, or the principal representative for Boston of any stock or mutual fire insurance company, is eligible for membership in the Boston Board of Fire Underwriters. On January 15, 1929, there were fifty-six members.

THE BOSTON PROTECTIVE DEPARTMENT. This department is maintained by the insurance companies, the expense being apportioned to the various companies according to premiums received in the city. The Protective Department answers all fire alarms in order to protect against losses from water damage or any other factor, restoring sprinkler protection and cleaning up after the fire. It compiles fire loss and premium figures for the City of Boston, preparing brief summaries of the city's fire record from year to year.

RISK. Insurance term for property insured.

LOSS-COST. The ratio of fire loss to amount at risk.

LOSS RATIO. The ratio of fire loss to premiums received.

AVERAGE RATE OF INSURANCE. Total premiums received divided by the total amount of insurance at risk.

FLAT RATE.—That rate of insurance per \$100 of value at which a policy may be written without the use of a reduced rate contribution clause.

AN 80 PER CENT REDUCED RATE CONTRIBUTION CLAUSE RATE. That rate of insurance per \$100 of value at which a policy may be written which contains a clause stating that the assured agrees that in the event of a partial loss, it shall be settled for an amount which bears the same ratio to the loss sustained, as the amount of insurance carried bears to 80 per cent. of the value of the property insured.

The foregoing discussion brings out the fact that Boston's fire insurance rates are not based on the fire loss in Boston alone. The rates are influenced by Boston's fire losses which are taken into account in the local rating, but the rates must, at the same time, give weight to state, and to a lesser degree, national experience.

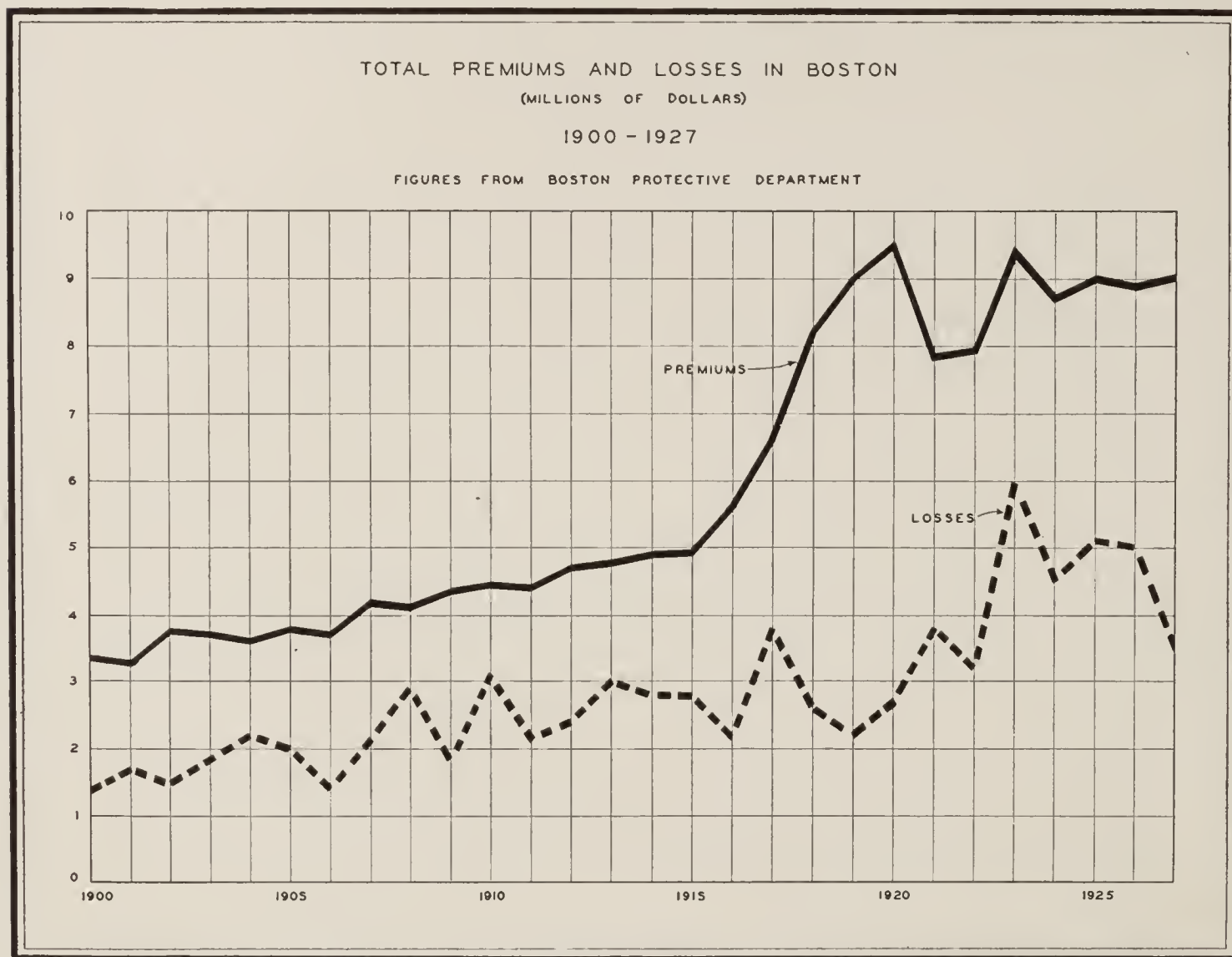


FIGURE 20.

To summarize; the fire insurance rates in Boston must first take into account the losses as experienced in the city alone. Having determined this loss experience, the final result must also consider the state fire loss, and the share of this loss which must be borne by the City of Boston. If the nation's fire loss experience is such that some of it must be shared by the State of Massachusetts, then Boston will automatically absorb its own share of the latter. The nation's fire loss is relatively an unimportant factor in determining local rates except in such unusual cases as that brought about by the San Francisco conflagration. The major proportion of the fire rate burden depends on Boston's own fire loss record.

A STUDY OF THE TOTAL PREMIUM CONTRIBUTED BY BOSTON

A comparison of the ratio of aggregate premium income received to losses incurred in Boston, and in the state, as well as in the country at large, should establish that Boston is, or is not, being discriminated against, as compared with other sections of the country. Such a comparison is not intended to imply that national or state rates, are equitable or inequitable, but rather to check the professed uniformity of stock company rating methods.

The total premiums and total losses for the City of Boston since 1900 are shown in Fig. 20, which is derived from figures reported to the Boston Protective Department by all fire insurance companies operating within the city. A further comparison is made in the following table, taking the five-year period from 1923 to 1927 to allow for the element of time. The figures for Massachusetts and the United States are those compiled by the Spectator Company for all stock companies operating in the state. (See also Fig. 22.)

PREMIUM INCOME AND LOSSES
(Figures given are Millions of Dollars)

YEAR	BOSTON		MASSACHUSETTS		UNITED STATES	
	Premiums	Losses	Premiums	Losses	Premiums	Losses
1923.....	9.40	6.00	29.42	17.55	622.13	328.52
1924.....	8.70	4.50	28.01	18.72	615.46	340.81
1925.....	9.00	5.10	29.54	17.16	657.30	361.95
1926.....	8.90	5.02	30.43	19.28	698.71	367.46
1927.....	9.05	3.50	29.64	15.81	673.13	313.35
	45.05	24.12	147.04	88.52	3,266.73	1,712.09
Ratio of Losses to Premiums (5-year average).	53.5%		60.2%		52.4%	

For the five-year period the City of Boston shows a higher ratio of losses to premiums than the country as a whole, but at the same time has a better record than that of the State of Massachusetts for the same period. However, as previously described Boston was called upon to bear its share of Massachusetts' heavy loss, and the rates were increased on those classes of risks in the city which had shown poor loss ratios.

It has been impossible to obtain any figures showing the total amount at risk in the City of Boston, for they are not compiled by the insurance companies. If the total amount at risk, were known for the City of Boston, with the total premiums which are indicated in Fig. 20, the total premium received, divided by the total amount at risk, would have produced an average rate over the city. Such figures were obtainable for the various states, and for the United States.

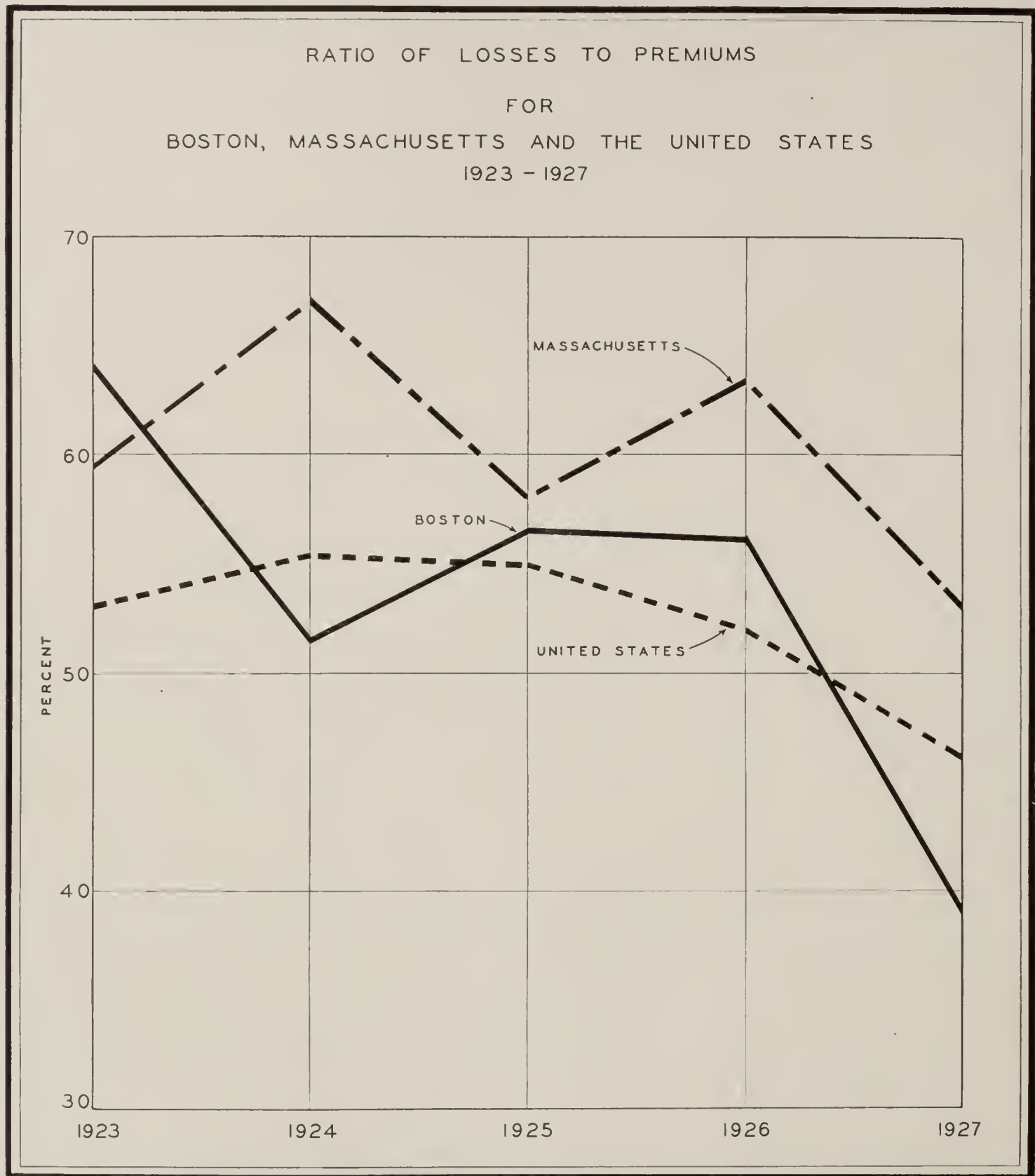


FIGURE 22. (From table, page 21.)

This comparison has been made, however, for the State of Massachusetts and the nation for this five year period.

AVERAGE RATE OF INSURANCE		
YEAR	MASSACHUSETTS	UNITED STATES
1923	.91	.97
1924	.92	.97
1925	.89	.97
1926	.83	.93
1927	.91	.94

From the above figures it is apparent that the State of Massachusetts has enjoyed a lower average rate than the country as a whole, and yet the fire record for the State shows a higher loss ratio. On this basis alone Massachusetts does not appear to have been unjustly rated in the aggregate.

It is regrettable that this specific comparison cannot be made for the City of Boston, due to lack of data,¹ and consequently an average rate of fire insurance for the city cannot be calculated. The fact is established, however, that Boston's loss ratio (losses to premiums) is higher than for the country as a whole, that is, the loss paid out per dollar collected is greater in Boston than in the country at large. It is therefore fair to conclude that compared to the rest of the country the total premium contributed by Boston is not excessive for the losses experienced.

It was considered that a ten-year period from 1918 to 1927, inclusive, might produce averages which would be of more value than the five-year figures above listed. The years from 1918 to 1922, inclusive, however, were abnormal throughout the country, including Boston, and conclusions drawn from these years would not indicate normal experience. A brief mention of the conditions during this period should be made at this time to justify the use of the recent five year period only.

During the earlier period (1918-1922) there was a marked increase in the amount at risk, which coupled with low fire losses during the years following the world war, resulted in a very low loss ratio for Boston in 1918, 1919, and 1920. Boston showed a far better loss ratio for these years than did the country as a whole, or the State of Massachusetts. It is unfortunate that these good years were followed by loss ratios of 65 per cent., 56 per cent., and 57 per cent. in 1923, 1925, and 1926. These latter loss ratios were well in excess of the average for the whole country, and such losses placed Boston in a poor light in the eyes of the insurance companies operating in the city. These poor loss ratios of 1923, 1925,

¹ Losses and amounts at risk are furnished by the companies for the various states, but not for the City of Boston.

and 1926, as compared to the good loss ratios of 32 per cent., 25 per cent., and 26 per cent. for the years 1918, 1919, and 1920, respectively, represent approximately \$2,700,000 annual difference in total losses, which the insurance companies had to pay. This is illustrative of the heavy fluctuation in loss experience which the rates must be designed to cover.

Boston's high fire losses of 1923, 1925 and 1926 contributed to the high loss for Massachusetts, so that when the insurance companies asked for more premium income from this state, Boston could not be exempted from contributing to the increase in premiums.

In Fig. 20, the curve showing premium income during the profitable years indicates a considerable increase in the total premiums collected in Boston. This apparently was not due to increases in rates during that period, but to an increase in the amount at risk written. That is, property owners carried more insurance. Records show that in Massachusetts from 1917 to 1920 there was an increase in the amount at risk of eleven billion dollars. It is fair to assume that proportionate increases took place in the city.

The year of 1927 has shown marked improvement with a loss ratio of 39 per cent. If a similarly good record can be continued, it would justify a reduction in the total premiums collected in Boston and would constitute sufficient evidence to warrant downward revision of rates by the companies operating in the city.¹

In the light of the above figures it appears that had Boston experienced a good fire record from 1923 through 1926 a reduction in rates would now be warranted. The fairest method of making such reductions would have been to reduce rates only on those classes of property which had had good fire records. The rates on good classes could thereby have been reduced more than if a flat reduction were made. These unprofitable years mentioned have caused the companies to profess concern as to the future stability of operation in the city and have served as an effective barrier to a downward revision of rates.

SPECIFIC RATING IN BOSTON

While the aggregate premium contributed by Boston is approximately equitable in view of the fact that the ratio of premiums to losses must necessarily be constant, taking the country as a whole as the standard, it does not necessarily follow that specific rates are equitable.

Whether it is possible to prevent inequities in specific rates is a matter of opinion. The elimination of inequities would require exhaustive study, and thorough cooperation between the insurance companies and the public. This problem of specifically rating individual properties, is not well understood outside

¹ Since the writing of the above, the 1928 fire loss figures for Boston have become available and show a loss ratio of 37 per cent.

of insurance circles and is the cause of controversies between the individual owner, the city or the state on the one hand, and the insurance interests on the other. For this reason it is important to emphasize the following points regarding specific rating.

The popular conception is that rating schedules, such as used by the Boston Board of Fire Underwriters, produce actual measurements of the fire risk involved. They are believed to measure the fire cost of a property, which is the expected loss, plus expenses, plus a reasonable profit to the insurance company. This, in reality, is not a fact and is not claimed by the rating authorities to be an exact measurement. It is true, however, that rates produced by schedule rating place one risk *relatively* on a fair basis with other risks of its own class, but no proof can be brought forward that will establish the accuracy of the rates which the schedules produce on a given risk in a class as compared to any risk in another class. At their best they are estimated rates; the general level for the class is decided upon and a schedule devised to produce the predetermined rate. For example, a certain average risk in some given class is estimated as worth about \$1.25 per \$100 of insurance. A schedule for such a risk is devised so that with normal conditions about \$1.25 will be produced. By using a 50-cent base rate, plus arbitrary charges for physical differences, a rate of about \$1.25 is produced for the average risk. Certain risks in this class, being physically better than others in the same class, will rate below the general level; poorer risks will rate above, but compared to risks within the same class they are not discriminated against by such a schedule.

That the predetermined rate for the class is correct, cannot be proven by actual loss-cost experience, because the rating bodies do not know themselves. The bases for these predetermined rates are insurance company estimates, but figures are not available to verify them. In other words, it is comparatively easy to prove that in the aggregate and over a long period, insurance companies do not receive exorbitant prices for the indemnity which they sell, but the companies collectively have not established the equity of class rates.

It is probably true in Boston, as elsewhere, that insurance is sold too cheaply to poor risks and too dearly to good risks. If every class of risk were rated strictly on loss-cost experience over a long period of time it is probable that insurance rates would be prohibitive for the poorer classes of risks. If an attempt were made to readjust rates in Boston on a precise class equity basis, many classes of risks would suffer large increases in rate.

It is felt that the Boston Board has made a conscientious attempt to apportion the rates on various classes of risks in Boston as fairly as possible with the loss experience available. The Board itself does not possess detailed classified experience for the various types of risks.

Specific Rating Schedules in Use in Boston. The rating schedules in use in the City of Boston by which the majority of specific rates are computed, include the following:

	BASE RATE
The Universal Mercantile Schedule	\$0.26 or \$0.13.
The "Short Schedule" . . . . .	.20 (Boston) \$0.25 (Hyde Park).
The Sprinklered Risk Schedule . . . . .	.04.
The Metal Schedule . . . . .	.75.
The Theater Schedule	Varies (\$0.50 to \$2.00 according to conditions).
The Pier Schedule	\$1.00.
The Woodworking Schedule	\$3.00 — \$2.50 or \$3.25.
Use and Occupancy Schedule	(Function of Building Rate).

The uses for the schedules as shown above are practically self-explanatory with the exception of the "Short Schedule." This schedule is used to rate buildings occupied in part for mercantile purposes, buildings of other than first or second class construction, and apartment houses of other than fire resistive construction which are not provided for under minimum rates.

The base rate for the mercantile schedule, by which the majority of buildings are rated, is computed in the following manner:

	\$0.25	(Key rate for city.)
	.02	(Charge for narrow streets.)
	.02	(Charge for electric trolleys.)
	—	
	\$0.29	
	.029	(Credit for chemical and ladder equipment.)
	—	
Base rate	\$0.261	

Formerly charges were made for "poor fire record" and for inefficient administration in the fire department.

From this calculation, a 26-cent base rate is used for "fireproof" buildings, and a 13-cent base rate is used for the "non-fireproof" buildings which is one half of the "fireproof" base rate. The use of the lower base rate would seem illogical, but the method of scheduling is entirely different. Instead of starting with a 26-cent base rate for "non-fireproof" buildings and then giving certain credits, these reductions are given at the beginning by halving the base rate. For the "fireproof" buildings the full 26-cent base rate is employed, but the various credits absorb the 13-cent difference. In other words, different base rates are employed merely for rating calculations, and do not in themselves represent any definite measurement of basic fire risk.

The other base rates are purely arbitrary selections, to produce, as previously explained a predetermined result, based on insurance company estimates. No apparent reason can be found for the use of a higher base rate for the "Short Schedule" in Hyde Park.¹

It is impossible to say whether the rates as produced by the application of these schedules are adequate or inadequate, because to determine this would require exact knowledge of the amount of losses experienced to the *amount at risk* for each class of building over a long period of time. Such figures are not in the possession of the Boston Board of Fire Underwriters nor are they apparently available from any other source.

These schedules may be exacting too little premium from one class, and too much from another, but they generally produce consistent rates for each class. Further than this, no exact justification for the individual rates can be produced. Existing specific rates may be too low as well as too high.

In spite of the lack of concrete evidence to justify the rates thus produced, schedule rating has distinct merit. It minimizes discrimination in the same class of risk. It is also an effective instrument for encouraging individual fire protection, in that credits are given which stimulate the individual owner to improve his property for the sake of lowering his insurance premium.

There is undoubtedly lack of equity in rates, especially as regards the level of rates on some classes of property. The various rating methods used, and the differences in rating schedules, bring about rates which may not be justified by loss experience. This is more or less true in other cities as well as in Boston, and in general should not be considered as intentional "discrimination," as the schedules are applied to everyone alike. As previously stated, the tendency is probably towards too high rates on the better types of property, and too low rates on the more hazardous properties.

It would seem reasonable that the combined loss experience of insurance companies on specific classes of property should be available so that rating organizations like the Boston Board would have definite figures to guide them in determining the level of rates for each class. It would certainly be desirable to have figures for the experience in the country as a whole or in the respective states. Where the Boston Board has jurisdiction over the city alone, it should have such experience figures for Boston as well, covering premiums, losses, and amount at risk, for all important classes.

If such figures should show that certain classes of property have especially low loss ratios, the rates or schedules applying to those classes should be revised so that the class pays an amount in premiums proportional to the losses sustained by that class. Classes most likely to be affected by such reductions are those like

¹ As a result of this study, the Boston Board has made the base rate for the "short schedule" uniform at 20 cents for the whole city.

fire resistive buildings, sprinklered risks, dwellings and apartments, which are already rated low because they may be "improved" or "preferred" risks. To obtain such a classification the owners have frequently expended large amounts of money in a direction which tends towards a reduced fire loss in the city. It may be therefore that experience would not only justify reduced rates on these improved risks but it is in line with good public policy to encourage or reward the owners of such properties with the lowest possible rates as determined by experience, to the end that all property owners are given every possible incentive to improve their properties by better construction, protection and care of hazards.

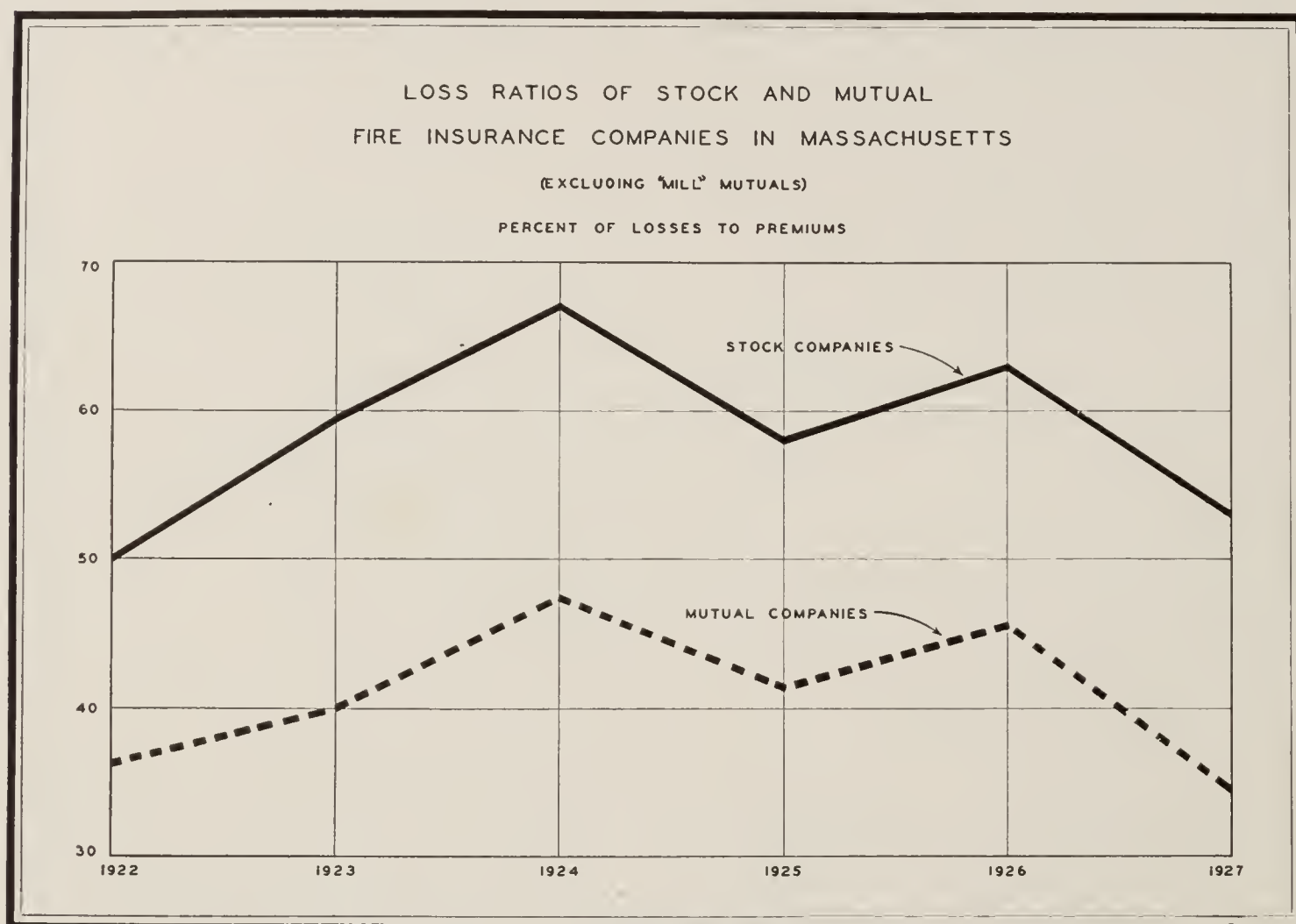


FIGURE 28.

Factors Tending to Make Specific Rates Equitable. There are several factors which tend to keep the general level of individual rates on a fair basis. Mutual fire insurance company competition is one of these factors. Fig. 28 shows the loss ratios in Massachusetts of the mutual fire insurance companies, excluding the "mill" mutuals, as compared to stock company loss ratios, and is indicative of the difference in the type of risk written by the two types of organization. The "mill" mutuals are not included, as the type of risk they accept, large isolated industrial plants, is not comparable to the majority of property as found in Boston.

From this figure of loss ratios, it can be seen readily that the mutual companies, operating in Boston, are selecting the so-called preferred risks, which enjoy low average loss ratios. Such mutual competition tends to keep the rates of this class of risk at a minimum. The more hazardous risks are not affected by mutual competition, and in view of the heavy losses in such properties, are probably not being overcharged. There is rather the possibility that they are undercharged in proportion to their fire loss.

The modern agency and brokerage system in Boston, maintaining its fire protection and rating engineers, is another factor tending to keep rates at low levels. Keen competition to obtain business results in rates being constantly reviewed in the attempt to obtain concessions for customers, and although the work of the agency engineer is chiefly limited to obtaining credits possible through the application of the various schedules, it does, nevertheless result in every possible consideration being shown to the individual owner.

Every insurance company, doing business in the city, is also competing for business with the other companies, and this company competition tends to keep rates at the lowest level possible under the present rating standards. For example, if some companies have found certain classes of property profitable risks, the tendency is for these companies to influence the rating organizations to reduce the rates on these classes, both from fear of mutual company competition and to enable them to quote lower rates to prospective assureds in these profitable classes.

Minimum Rates in Force in Boston. Thus far only those rates which are made by the application of the schedules have been considered. These rates are known as "specific rates," as contrasted to "minimum rates." Minimum rates are published by the Boston Board of Fire Underwriters, and apply to such properties as dwellings, apartment houses, churches and public buildings. These minimum rates are applied according to a few general factors with no attempt to specifically analyze each property. The more important classes which are minimum rated are dwellings and apartments.

There are some fundamental differences in the application of minimum rates in Boston as compared to the state as a whole, and a careful study of these differences is warranted before drawing any conclusions. For purposes of comparison one type of risk has been selected, and similar comparisons can be made for other types by consulting the minimum rate books for Boston and Massachusetts.

The following indicates the rates applying to certain dwellings and apartment houses in Boston, as compared to Massachusetts. The Massachusetts rates vary according to the construction, and according to the classification given the city by the National Board of Fire Underwriters. Boston's rating methods are not based on the National Board grading system, but since the city, in protection

and construction, compares with other cities in Massachusetts which are given a second class grading, the rates for second class cities in Massachusetts have been shown in the following table for purposes of comparison.

DWELLING AND APARTMENT HOUSE RATES
PER \$100 OF INSURANCE
(Second Class Cities)
Brick Walls and Non-Combustible Roof Coverings

NUMBER OF APARTMENTS	BOSTON			MASSACHUSETTS		
	FLAT RATE		80% COINSURANCE BUILDING RATE	FLAT RATE		80% COINSURANCE BUILDING RATE
	Building	Contents		Building	Contents	
2 (no more)14	.18	—	.12	.17	Not used.
3 (no more) . . . . .	.20	.25	.14	.15	.20
4 (no more) . . . . .	.25	.30	.18	.19	.24
5 to 8 (inclusive) . . . .	.34	.39	.24	.23	.28
9 to 12 (inclusive) . . . .	.42	.47	.30	.28	.33
13 to 16 (inclusive) . . . .	.55	.60	.39	.36	.41

In the table the stipulations for the rates as used for Massachusetts are those which are comparable to the conditions as found generally in Boston, namely, the risks were considered as within two miles of a fire station and within 500 feet of a hydrant.

The main difference to be noted is that for the buildings the Boston Board of Fire Underwriters also publishes an 80 per cent. reduced rate contribution clause rate, while in Massachusetts flat rates only are published.

From the table it will be noted that all dwellings in Boston are flat rated higher than in other Massachusetts cities of like grading. This excess flat rate varies from \$0.02 to \$0.19 per \$100 of insurance, according to the number of apartments. However, the Boston 80 per cent. reduced rate contribution clause (or "coinsurance") rate follows more nearly the flat rate in use in other Massachusetts cities, being slightly below in two cases, and slightly above in three other instances. The difference between a "flat rate" and an "80 per cent. reduced rate contribution clause rate" as it affects the individual property owner is explained below.

If a property is insured at a flat rate, the policy covering this property does not contain a reduced rate contribution clause. If the same property is insured at the so-called "80 per cent. reduced rate contribution clause rate," the policy *must* contain the 80 per cent. clause. In non-technical terms, this clause makes the assured a party to the following contract: the assured agrees,

that in the event of a loss, the insuring company shall be liable for no greater portion of the loss, than the amount of the policy bears to 80 per cent. of the actual value of the property so insured.¹

Under this clause, the property owner must carry more insurance than he would perhaps carry at a flat rate and would therefore pay more premium for which he receives more protection in event of a total loss.

While the principle of an 80 per cent. contribution clause rate for dwellings in Boston is sound because it encourages the owner to carry full insurance coverage, under such a plan the "80 per cent." rate in Boston should be lower than the flat rate in Massachusetts. As it is now the Boston property owner pays practically as high a rate on the "80 per cent." basis, where he must carry a specified amount of coverage, as the property owner elsewhere in the state does on a "flat" basis with no requirement as to coverage.

Except as above stated, the 80 per cent. coinsurance rates are not comparable to the flat rates of Massachusetts, but it is believed fair to compare the flat rates of both territories.

Regardless of the building rates, unless specifically asked for, only the higher flat rates can be used for contents coverage in Boston, and these are, as stated before, higher than for similar coverage in other Massachusetts cities of like grading. From data available it would appear that the higher flat rates applying to Boston dwellings and apartments require further justification if a conclusion of discrimination is to be avoided.

The flat rates for combustible roofed dwellings and apartments of either brick or frame construction, are similarly higher in Boston than throughout the state. The same conclusion applies.

Other Specific Rate Comparisons. The comparisons indicated in the following table showing rates on similar buildings located in other cities as compared to those in Boston were submitted by the Boston Board of Fire Underwriters. As previously stated, a comparison of the rates applying in different cities and in different states can be, at best, only a rough comparison and may indicate nothing at all as to the justness of either. It does indicate, however, that, generally speaking, rates in Boston are not radically out of line, but that the equity or inequity of the distribution of Boston's fire cost is still an open question. With the present data available no one can positively say whether specific rates in Boston are too high or too low.

¹ For example, if the insurable value of a property (replacement value at time of fire, less depreciation) is \$10,000, the 80 per cent coinsurance clause provides that if the owner desires full indemnity in case of a partial loss, he must carry at least 80 per cent. of \$10,000 or \$8,000 insurance. If he carries only \$4,000 insurance and has a partial loss of \$1,000 he will collect only four eighths of \$1,000 or \$500. If he carried \$4,000 insurance without the 80 per cent. coinsurance clause (*i.e.*, at a flat rate) he would collect the entire loss, namely, \$1,000 instead of the \$500 as previously described. (It has been suggested that the use of a "deductible average" clause similar to that used in automobile and marine insurance might also be practical for certain classes of risks in fire insurance contracts.)

TYPICAL AVERAGE RATES IN BOSTON COMPARED TO SIMILAR AVERAGE RATES IN NEW YORK, PHILADELPHIA, BUFFALO, PITTSBURGH AND BALTIMORE

UNSPRINKLERED CLASS	GRAND AVERAGE OF SIX CITIES		BOSTON AVERAGE		PERCENTAGE DEVIATION OF BOSTON FROM AVERAGE	
	Building	Contents	Building	Contents	Building	Contents
A.....	.158	.378	.107	.265	32% below.	30% below.
B.....	.263	.480	.249	.374	5.3% below.	22% below.
C.....	.185	.566	.182	.637	1.6% below.	13% above.
D.....	.471	1.03	.463	1.493	1.7% below.	45% above.
E.....	.361	.934	.305	.919	15% below.	1.6% below.
F.....	.723	1.34	.573	1.50	21% below.	12% above.
G.....	.518	1.19	.581	1.395	12% above.	17% above.
H.....	.283	.855	.203	.835	29% below.	2.4% below.
I.....	.501	1.34	.546	1.85	9% above.	38% above.
SPRINKLERED CLASS						
J.....	.117	.299	.128	.334	9.4% above.	12% above.
K.....	.288	.508	.274	.604	4.9% below.	19% above.
L.....	.119	.275	.071	.176	40% below.	36% below.
M.....	.257	.444	.230	.484	11% below.	9% above.
N.....	.097	.270	.084	.249	13% below.	7.8% below.
O.....	.427	.678	.29	.666	32% below.	1.8% below.
P.....	.130	.384	.113	.475	13% below.	24% above.
Q.....	.420	.701	.31	.758	27% below.	8% above.

KEY TO CLASSES

Unsprinklered

- A — Fire resistive office buildings.
 B — Fire resistive hotel buildings.
 C — Single tenant light hazard mercantile risks, fire resistive buildings.
 D — Same, non-fire resistive buildings.
 E — Single tenant heavy hazard mercantile risks fire resistive buildings.
 F — Single tenant heavy hazard mercantile risks, non-fire resistive buildings.
 G — Fire resistive garages.
 H — Women's apparel, retail, fire resistive buildings.
 I — Women's apparel, retail, non-fire resistive buildings.

Sprinklered

- J — Fire resistive department stores.
 K — Non-fire resistive department stores.
 L — Single tenant mercantile risks, fire resistive.
 M — Single tenant mercantile risks, non-fire resistive.
 N — Single tenant manufacturing risks, fire resistive.
 O — Single tenant manufacturing risks, non-fire resistive.
 P — Multiple tenant manufacturing risks, fire resistive.
 Q — Multiple tenant manufacturing risks, non-fire resistive.

Boston building rates lower than grand average in 14 cases.

Boston building rates higher than grand average in 3 cases.

Boston contents rates lower than grand average in 7 cases.

Boston contents rates higher than grand average in 10 cases.

(See also Appendix to Part II for tables from which the above was summarized.)

GENERAL FIRE INSURANCE PRINCIPLES APPLYING NATIONALLY AS WELL AS TO BOSTON

State Laws. State regulation is occasionally proposed as a solution of the fire insurance rating problem. Due consideration has been given to the proposal and its application in other jurisdictions and it is concluded that thus far state regulation of fire insurance rates has failed to prove its ability to assure equity in rates.

Anti-compact laws¹ have not produced lower rates and have tended to increase discrimination. The workings of these laws have been such as to take the rate making out of the hands of the companies, who are in direct contact with the business, and place it in the hands of those who do not have the information necessary to estimate rates properly.

A joint report made by a committee of the Senate and Assembly of New York State² confirms the above conclusions. This report found that:

1. Equitable rates demand cooperation, and a combine is essential in rate-making to prevent duplication, and lessen the administrative expense.

2. Open competition among stock companies causes unstable conditions for both companies and assureds and has resulted in discrimination. The man with influence can obtain concessions in rate, to the detriment of the average policy holder.

3. Anti-compact laws have not proven a remedy for competitive difficulties, since they have provided only a weakened substitute in the form of "advisory rates," which have little sound derivation.

4. The complete control of fire insurance rates by the various states has the disadvantage that political influence has prevented insurance companies from recouping from conflagrations, experienced within or without the state in question, and has brought upon the states added expense to maintain rating experts.

Expenses of Doing Business. For the five-year period ending 1927, the ratio of insurance company expenses to premiums collected for the whole country was 45.4 per cent. A similar figure is not available for either the State of Massachusetts or the City of Boston, because the insurance companies do not report such data.

¹ Certain states considered rating bureaus maintained collectively by insurance companies as "combines" to fix insurance prices. The so-called "Anti-compact" laws forbade such combinations.

² Report of the Joint Committee of the Senate and Assembly of the State of New York, transmitted to the legislature February 1, 1911, under the chairmanship of Hon. Edwin A. Merritt, Jr.

Operating expense of insurance companies includes such items as the cost of rating and inspection bureaus, home office expenses, commissions to agents, salaries of field men, expenses incurred in the adjustment of losses, and similar items. It does not include payments for fire losses.

This operating or administrative expense is an item entirely outside the control of any municipality like Boston. That fact, together with the total lack of data on the expense of insurance companies which may be apportioned to their Boston business, makes it an item which this report cannot well cover.

Also, the problem of insurance company taxes should be analyzed as a part of state taxation. It is beyond the scope of this report. The individual rate on any property must, however, include this tax.

Of the tax imposed by the state of Massachusetts, only about 5 per cent. is used for maintaining the State Insurance Department. Nevertheless, all of this tax is an added cost to the companies and is naturally passed on to the individual assured in increased rates. The provident pay the tax and the improvident escape. The total insurance tax in the State of Massachusetts last year amounted to approximately three million dollars.

CONCLUSIONS REGARDING STOCK COMPANY FIRE INSURANCE RATES IN BOSTON

The purpose of this report is to study the basis for the fire insurance rates in Boston and to determine, if possible, whether such rates are excessive. Some of the following conclusions embody matters within the control of the City of Boston or its citizens and others include problems for state and even national consideration. The conclusions are as follows:

1. On the basis of conditions in the country as a whole the total premiums contributed by Boston during the past five years have not been excessive in view of the losses experienced.

2. There are undoubtedly inequalities in the rates on the various classes of property in Boston, with the tendency towards too high rates on good risks, and too low rates on poor risks. While it is felt that an honest effort has been made by the Boston Board of Fire Underwriters to fairly apportion the aggregate premium among the various classes, lack of necessary experience data has undoubtedly prevented desirable equity in this distribution.

3. Competition from mutual companies produces a natural trend toward rate equity among the better classes of property, and competition among agents tends to produce rate consistency within the classes.

4. The use of a higher base rate for the "short schedule" in Hyde Park does not appear justified.¹

¹ See footnote page 5.

5. The minimum flat rates for dwellings and apartments in Boston are higher than those applying on similar property throughout the state and should be substantiated by experience data or reduced.

6. For a more equitable adjustment of rates in Boston figures should be in the possession of the Boston Board of Fire Underwriters which would show losses, premiums, and amount at risk for all important classes of property, for Boston, as well as the country at large.

7. Present specific rating makes it possible for individual property owners to reduce their particular rate by taking advantage of the credits allowed for definite improvements. Competition between insurance agencies and from mutual companies guarantees that improved risks will receive lower rates.

8. The fire loss record in the City of Boston for the years 1923, 1925 and 1926, showed excessive losses to premiums, and has been an apparently justifiable reason for high rates in the city. The loss ratios for 1927 and 1928 were exceptionally good (39 per cent. and 37 per cent.) and a continuance of this good record would constitute justification for lower rates properly distributed over the whole city.

9. The quickest and surest way to reduce the cost of fire insurance is by reducing the fire loss.

Of the two factors entering into the loss ratio the public has no direct control of one — the insurance companies cost of doing business which must be added to the losses in determining the amount of premiums that must be collected. The other factor, that of fire losses, is directly within the control of the public. Indirectly, the losses affect the insurance companies' cost of doing business, so that if losses are reduced, expenses are reduced somewhat also, and the total premiums required are reduced. This would make insurance rates lower.

To reduce Boston's fire loss one half is well within the realm of possibility and as a sustained reduction of that amount would bring a substantial lowering of insurance costs it is a goal worth striving for as it would represent *annual* savings to Boston citizens measurable in millions of dollars.

The following part of this report is therefore prepared to indicate why Boston's fire losses have been so high in the past, and just what steps can be taken to reduce those losses.

PART III

THE FIRE WASTE

CHAPTER 1

WHAT THERE IS TO BURN IN BOSTON

In order to understand the fire problem of Boston, a picture must first be given of what there is to burn in the city. As regards "burnability" the city is by no means homogeneous, for certain sections represent a considerable fire hazard, while the hazard of other districts is not particularly serious. There are many sections of the city, however, where a very large fire is possible.

Accompanying maps show the principal types of building construction in Boston. These are of three major kinds, fire-resistive, brick and frame. The fire-resistive type has fire-resistive walls, floors and roofs. The brick type has masonry walls, with floors, interior partitions and roof structure of wood, usually joist, but sometimes heavy timber construction.¹ The frame type is of wood throughout. The type of construction is important because the character and arrangement of the building affects not only its own fire hazard, but that of its contents as well.

Fig. 38 shows the entire city and indicates what areas are built up. The other and larger scale maps show areas of either fire-resistive or brick construction. By comparing these latter maps with the one showing the built-up areas, the portions occupied by frame construction can be visualized. Difficulty in photographing the maps has made it impracticable to show all three types of construction on one map.

GENERAL DESCRIPTION OF STRUCTURAL CONDITIONS IN THE CITY

Charlestown, East Boston, South Boston. (Fig. 39.) The fringe of wharves in Boston proper, Charlestown, East and South Boston is largely made up of frame structures which are very bad from a fire standpoint. There are a few fire-resistive wharf structures, notably Commonwealth Pier, the Army Base and a railroad freight terminal in East Boston. In general, the freight terminals

¹ In this study it has not been practicable to differentiate between two types of brick-walled wooden interior construction which have quite different burning characteristics. The ordinary wooden interior construction has light floor joists which make for rapid burning. Heavy timber construction, designated as "mill" or "slow-burning," uses only timbers of relatively large dimension presenting a minimum of combustible surface and having no concealed spaces through which fire may spread. Where vertical openings are properly protected and particularly where automatic sprinkler protection is provided, this type of construction has shown favorable fire experience. In the downtown district of Boston there is some mill construction, but such buildings in few cases are equipped with automatic sprinklers and have vertical openings properly protected.

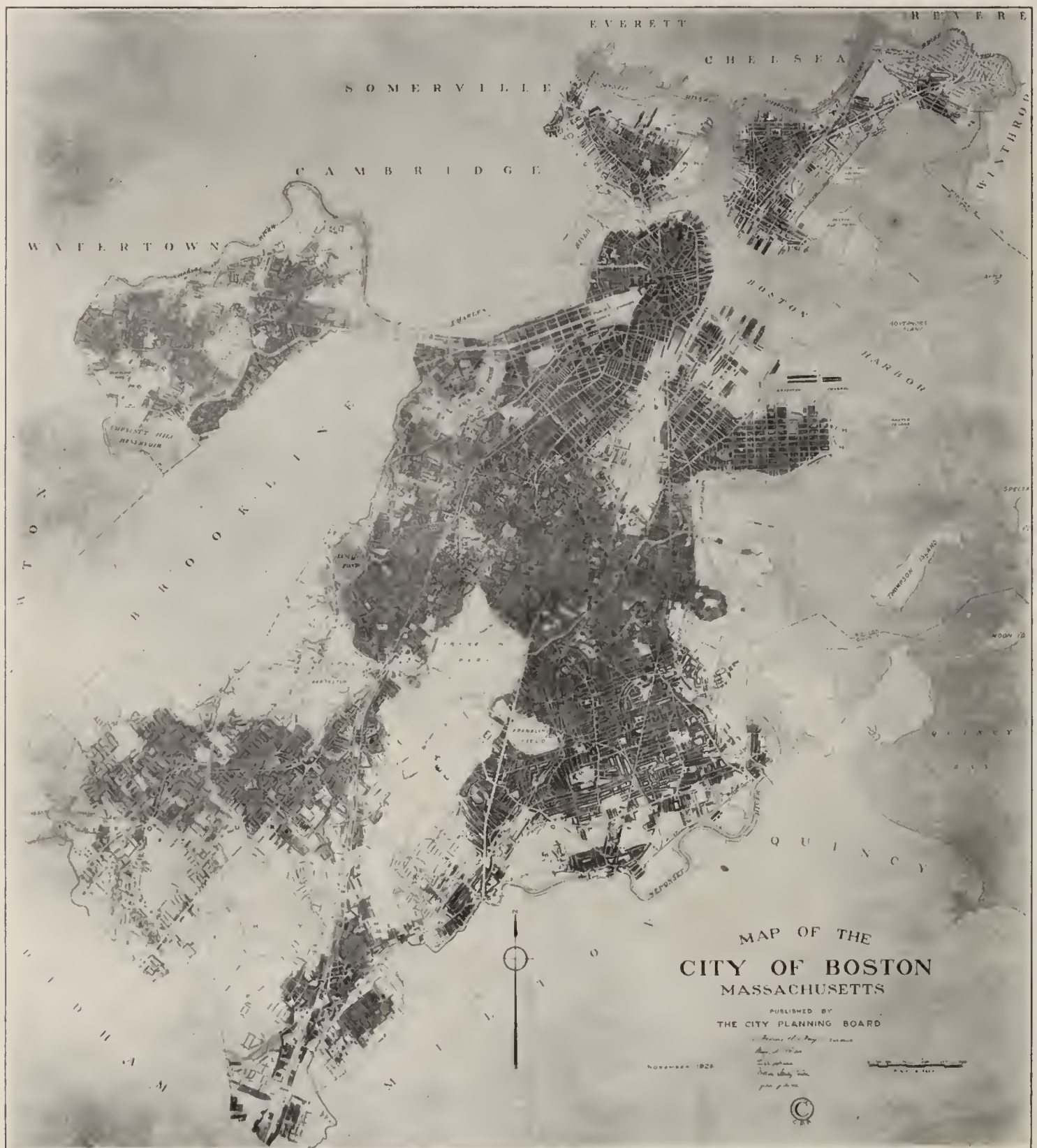


FIGURE 38.

The shaded areas on the above-reproduced map are those which are occupied by buildings. This map does not differentiate between types of buildings. Most of the outlying districts of the city are of frame construction, as may be seen by comparing this map with Figures 39, 41, 42 and 43, which show buildings of fire-resistive or brick construction. (Map made by plotting Sanborn Map data on a City Planning Board Map.)

of Boston, both railroad and marine, are not of fire-resistive construction. Huge values are concentrated in these warehouses and wharf buildings. A large fire in any one of these might strike a serious blow at the commercial welfare of the city.

The preponderant type of construction in Charlestown is frame, there being block after block of frame buildings interspersed with an occasional brick-walled wooden building. Along Rutherford Avenue there are many freight sheds



FIGURE 39.

Fire Districts 1, 2, 3, 4 and 6.

Charlestown, East Boston, Downtown Boston and South Boston. Shaded portions show areas occupied by buildings of either fire-resistive or brick construction. Except for the shaded spots shown, the construction in Charlestown, South Boston and the southern part of East Boston is closely-built frame. Most of the waterfront structures are frame. Compare Fig. 38. (Map made from Sanborn Map data.)

of inferior construction housing considerable values. The construction throughout this whole district is very weak and creates a potential conflagration area.

East Boston is also predominantly of frame construction, especially along Maverick Street, beyond the Airport and south, where there is a very closely built four-story frame district. In several blocks there is practically no fire break of any importance for a thousand feet or more. The southern and western parts of East Boston are also very closely built, while the northern and eastern ends are only beginning to be built up.

South Boston, south of First Street, is very closely built, mostly with three and four story frame residence buildings. The possibility of a sweeping fire here is very marked because of the concentration of frame construction. South Boston also has a considerable amount of industrial property along the Fort Point Channel and around the Army Base Channel.

Downtown Boston, Roxbury and Jamaica Plain. (Fig. 41.) Downtown Boston, which may be taken as that part of the city north and east of Massachusetts Avenue and otherwise bounded by the South Bay, Fort Point Channel, the harbor and the Charles River, is very closely built, ordinary brick construction predominating. This district is described in detail later.

Predominatingly brick construction is also found for several blocks south and west of Massachusetts Avenue.

Around the Back Bay Fens there are several apartment house districts with apartments mostly six stories in height, of very inferior brick-walled and wooden interior construction.

Along Commonwealth and Brookline Avenues, in the automobile showroom section, there are numerous fire-resistive buildings. There are also the numerous first-class buildings of the several hospitals, colleges and other institutions in this neighborhood.

A general tendency toward frame construction begins at Ruggles Street and extends south. Through this district there are also many ordinary brick buildings, mostly apartment houses, brick-walled but with wooden interiors. Occasional fire-resistive garages are located in this district. There are numerous brick-walled and wooden interior buildings at minor mercantile centers scattered throughout this area.

In the district generally bounded by Blue Hill Avenue and Warren Street there is a decided conflagration area. This area of closely built frame "three-deckers" could be readily involved in a sweeping fire, due to the general lack of open spaces and buildings of good construction that would serve as fire stops.

West Roxbury, Dorchester and Hyde Park. (Fig. 42.) Except at a few minor mercantile centers, where there are brick buildings of wooden-interior con-



FIGURE 41.

Fire Districts 3, 4, 5, 7, 8, 9 and 12.

Downtown Boston, Roxbury, the Fenway and Jamaica Plain. Shaded portions show areas occupied by buildings of fire-resistive construction. Practically all of the areas of Roxbury, Jamaica Plain and Dorchester shown here, are, except for the shaded portions, of closely built frame construction. Compare Fig. 38. See Fig. 46 for construction of buildings in Downtown Boston. (Map made from Sanborn Map data.)

struction and an occasional fire-resistive garage, buildings in these entire outlying areas are of frame construction, largely of the "three-decker" type. Excepting Dorchester, however, the extent of the built-up area is small and consequently there is no great hazard.

The mercantile center of Hyde Park is of very weak construction and has already experienced a good many fires.

In the vicinity of the junction of Morton Street and Blue Hill Avenue, south of Franklin Field, in Dorchester, there is an area of closely built frame three-deckers with practically no fire stops. This neighborhood might readily be wiped out by a sweeping fire.



FIGURE 42.

Fire Districts 10, 12, 13, 14 and 16.

Dorchester, West Roxbury and Hyde Park. Shaded areas are occupied by buildings of fire-resistive or brick construction. These districts are practically all of frame construction, except the few buildings shown. Compare Fig. 38. (Map made from Sanborn Map data.)

There is some industrial property along the Dorchester shore front and along the Neponset River. In Hyde Park and Readville there are several large industrial properties and a few in the outskirts of West Roxbury.

Brighton. (Fig. 43.) With the exception of an apartment house district along Commonwealth Avenue, Brighton is sparsely settled. The apartments are of from four to six stories, mostly brick-walled with wooden interiors. There is only an occasional fire-resistive building in the district. There is a weak minor mercantile district along Harvard Avenue, in Allston, and around the junction of Market and Washington Streets, in Brighton. The prevailing construction in the rest of Brighton consists of frame residences, mostly two and three family.



FIGURE 43.

Fire District 11.

Brighton. Shaded areas are occupied by buildings of fire-resistive or brick construction. Brighton, other than the areas shown is of frame, relatively sparsely built. Compare Fig. 38. (Map made from Sanborn Map data.)

DOWNTOWN BOSTON.

Fig. 44 shows downtown Boston divided into districts for purposes of description. As far as possible areas of like building construction and general occupancy have been grouped together. The congested and high value district of Boston is contained primarily within the limits of the waterfront, market, general wholesale, manufacturing and warehouse, office, central retail and Park Square districts. The North and West Ends and the Back Bay-Beacon Hill districts are mainly residential. No attempt has been made to subdivide the South End in which construction and occupancies vary widely. Its residential sections are much like the North and West Ends but the industrial district bordering the South Bay is of special character.

Waterfront District. (Fire Districts 3 and 4.) The largest proportion of wharf construction in this district is frame. Almost all the wharves have large area frame sheds for housing the valuable commodities which pass over these piers. In these sheds large fires and heavy loss can occur. Even where there are brick structures in the wharf, they are generally unsprinklered and in small three to five story units. Maintenance is ordinarily poor. In these brick structures vertical openings are generally unprotected so that a fire can spread to involve any one building and where fire doors between these buildings are not in operative condition fires can spread from one building to another.

Market District. (Fire District 4.) The buildings in this district are practically all very old, being of brick walled but wooden interior construction. The unit properties are small. Vertical openings in the buildings are generally unprotected and the occupancy is fairly hazardous.

Manufacturing plants are intermingled with the food and produce wholesale houses in this district.

General Wholesale District. (Fire Districts 3 and 5.) This district is occupied by wool and cotton warehousing and shoe, leather and clothing storage. Frequently manufacturing operations are performed in these buildings as well.

A considerable proportion of the buildings are sprinklered (see Fig. 46) and some have automatic fire alarm protection. Most of the buildings have several business concerns in each so that in case of fire the loss is seldom limited to one concern.

Construction is mostly of brick walls with wooden interiors, a considerable proportion being of the heavy timber type. This is better than the light, wood-joint construction of some other parts of the city.

There is also a considerable number of fire resistive buildings scattered throughout this area.

Tremendous values are concentrated in this district.



FIGURE 46.
Fire Districts 3, 4, 5 and 7.

Manufacturing and Warehouse District. (Fire District 4.) This district is somewhat like the general wholesale district except that there is a greater number of manufacturing plants. Sprinkler protection is somewhat less general. Areas are seldom large, but occupancies are very hazardous, woodworking plants which make a hot quick fire being common.

Numerous clothing, shoe and other manufacturing plants are scattered throughout the district. Buildings frequently house a variety of hazards, retail, wholesale and manufacturing, and often numerous firms are in one building in which case a fire may do damage to several occupants.

Central Retail District. (Fire District 5.) This district contains a variety of occupancies including theaters, large department stores, small variety and specialty stores and a few office buildings.

Areas are frequently large but most of the large department stores are sprinklered and maintenance is very good. The theaters are generally well protected, but an occasional building of inferior construction, like the old Adams House, makes for the possibility of a large fire.

Office District. (Fire Districts 3 and 4.) This district is almost entirely of fire resistive office buildings. These are low buildings as compared to the skyscrapers of many cities, averaging from eight to fifteen stories.

This district of fire resistive buildings is an important barrier to the spread of a sweeping fire from the south to the north part of the downtown district or *vice versa*. (See Fig. 46.)

Park Square District. (Fire District 7.) This is a district composed almost entirely of fire resistive buildings of varied occupancies such as offices, hotels, garages, furniture stores, and factories. The larger and more hazardous properties, like the furniture stores and garages, are sprinklered so that on the whole the hazard of this district is low. The larger buildings in this and in the office district represent the best grade of new construction being built in the city. Except in the case of these districts there has been little tendency to fire resistive construction in Boston.

Tenement House Districts. (Fire Districts 4 and 7.) The tenement districts of the North, West, and South ends of the city are made up of small-area tenement buildings, crowded together on small lots. Most of these are of brick with wooden interiors and average from three to four stories. The first floor, in the majority of cases, is occupied by a store. These residential districts are mostly of a poor class. In the South End there are many occupied as lodging houses. Because of the closely built nature of these blocks, fires involving several tenements are possible and fire fighting operations are hampered by inaccessible rear yards and courts.

In the South End particularly, there are many dilapidated buildings which are probably not worth repairing, and are such fire hazards that they should be torn down.

Scattered through these residential sections are fairly large-area buildings, which, although they have brick walls, are entirely of wood construction inside and so arranged that a fire would quickly involve the entire building. These buildings are for the most part stables, in a few cases stables remodelled for manufacturing or storage occupancies. Because of their location in congested areas they constitute "conflagration breeders."

South End Manufacturing and Mercantile Districts. (Fire District 7.) A considerable proportion of the territory between Harrison Avenue and Albany Street through the South End is devoted to manufacturing properties. These are of several kinds. Between Bristol and Thayer Streets, a row of tenant manufacturing buildings are fairly typical, being brick walled with wooden interiors, mostly sprinklered.

The occupancy hazards are high, being those of woodworking, shoe manufacturing and similar operations.

In this district there are a few large single tenant manufacturing plants, well kept and well protected against fire. Lumber yards, coal pockets and similar occupancies, however, tend to make this district very hazardous.

Along each of the thoroughfares leading out of the city are many small retail stores.

Back Bay=Beacon Hill District. (Fire Districts 4, 5 and 7.) This district contains chiefly three and four story brick-walled wooden-interior buildings. The occupancy is generally high grade, many of the buildings being single private residences, although an increasing number of these are being remodelled for apartments and rooming houses. There is a sprinkling of fire resistive apartments throughout the district.

The worst buildings are several of brick and wood six or more stories in height which are occupied as hotels and apartments. The potential danger to life in such buildings of inferior construction is high.

In the general vicinity of Copley Square there are numerous fire-resistive hotels, and a few club and office buildings. Along Massachusetts Avenue, especially between Columbus and Commonwealth Avenues there is a minor mercantile district, mostly small retail stores. A few of the buildings there are fire resistive.

PUBLIC, INSTITUTIONAL AND SIMILAR BUILDINGS

Schools, churches, hospitals, institutions and public buildings generally present possibilities of large losses. Examples of these taken at random from

the local fire record are: the Bennett School in 1924, with a loss of \$75,000, the Ruggles Street Baptist Church in 1925, with a loss of \$91,000, the Scobey Hospital in 1925, with a loss of \$28,000, the Boston Y. M. C. U. in 1924, with a loss of \$56,000, fires in city property at Deer Island, in 1920 and 1921, aggregating over \$40,000 loss, and the Boston Arena in 1918, with a loss of \$233,000.

City property is within the control of the respective city departments. Large-value buildings insufficiently safeguarded should be sprinklered and their physical defects corrected. Many old city buildings house valuable records, which require greater protection. A competent fire-protection engineer should review the plans for new buildings and design the necessary protection for existing structures. Sundry large-value buildings privately owned also badly need protection, and the individuals or organizations in charge of private schools, hospitals and other institutions, should give special consideration to the prevention of the destruction of these buildings by fire. Many public and institutional buildings are so constructed that they could easily be completely destroyed by fire should one start under unfavorable conditions.

Detailed criticism of such buildings in Boston is beyond the scope of this report. The life hazard of schools, hospitals and places of assembly, is so grave that a complete fire survey of these properties is recommended.

“CONFLAGRATION BREEDERS”

There are many blocks in the city which due to hazardous occupancy, combustible construction, large areas, lack of protection to window openings, lack of interior fire protection or combinations of these defects would permit a fire of conflagration proportions. Several typical blocks containing buildings of the type indicated are described in detail in Appendix 1.

Individual buildings which are bad hazards are not necessarily included in this category unless they are so located that a fire in them may spread and involve adjacent property.

“Conflagration areas” made up of many blocks of closely built frame construction such as are found in East Boston, Charlestown, South Boston, and parts of Roxbury and Dorchester are not shown, for while a large sweeping fire could take place in those areas there is no one part of them that is much worse than another.

In all the blocks described large fires can occur. Frequent inspections and full enforcement of all laws applying can alone be relied upon to prevent large fires from eventually occurring. Where the “conflagration breeder” is a single bad building in a group it should be sprinklered and its major structural defects corrected. If such buildings are not worth protecting they should be demolished in the interest of common safety.



Views of two buildings of the type commonly described as "conflagration breeders." While both buildings have brick walls, they are large in area and the interior construction is largely wood, so arranged as to present no obstruction to the spread of fire horizontally and vertically from floor to floor to quickly involve the entire building. It was difficult to get any view at all of the factory at the left because it is so closely surrounded by tenements, and a complete view of the stable at the right was impossible due to the very narrow streets.

SUMMARY

Boston has been built up mainly with second and third class buildings, the former being brick-walled with wooden interior, and the latter being entirely of frame construction. Fire resistive buildings predominate only in the office districts.

The majority of the non-residential buildings, which house the resources of Boston's commercial and industrial enterprises, are brick-walled with wooden interior, often poorly fire-stopped, and with little protection for either interior vertical openings or exposed window openings. This prevailing type of construction, in downtown Boston and in the mercantile centers of the outlying districts, is supplemented by frame buildings, found particularly along the water fronts, and in the mercantile or industrial sections of Charlestown, East Boston, and parts of Hyde Park and Brighton.

Residential buildings in Boston consist chiefly of brick and frame apartments, with the single or two-family residences in a minority. The three-story

frame apartments or "three deckers" predominate as in few cities elsewhere in the country. These frame residential areas present serious conflagration possibilities, and are found in all the outlying districts, particularly South Boston and Dorchester.

The brick apartment houses are, as a general rule, not provided with "fire-stopping" where the floors meet the walls to prevent the rapid spread of fire from floor to floor, particularly in the older type structures found in Roxbury, the South and West Ends, and portions of the Back Bay and North End.

There are some large fire-resistive apartment buildings in the Back Bay, but the prevailing construction is brick with wooden interior. Also in this section are many large three-story brick private residences, with open stairs from the basement to the top floor, which present a serious hazard to life and property.

There are many large public, private, and institutional buildings scattered throughout the city in which due to poor construction serious fires can occur. In the congested areas are many buildings which, due to construction, occupancy, lack of protection, and proximity to surrounding property, constitute "conflagration breeders."

Taken as a whole, the city has been built up with exceptionally few first class buildings, with very few intermediate types, and with the indifferent or poorer types predominating.

In Appendix 1 will be found detailed descriptions of structural conditions revealed by the inspection of typical blocks in various parts of the city.

CHAPTER 2

THE EFFECT OF BUILDING LAWS ON STRUCTURAL CONDITIONS

From the description of building conditions in Boston it will be seen that from the viewpoint of this study they are far from satisfactory. The question arises as to what is being done about them. There is a building code governing the construction of new buildings. Is its influence and the result of its operation making for the greater fire-safety of the city? An answer to this is given in the following paragraphs.

THE BOSTON BUILDING CODE

Arrangement. The present Boston code has grown slowly for many years and has been frequently altered and amended. Naturally, there was no pre-arranged system of development and the result is a disconnected and very confused mass of regulations, often conflicting, and revealing some serious omissions. The difficulties encountered by practicing architects and engineers in working under such a code are numerous, although they have been reduced somewhat by the excellently indexed compilation now available. Nevertheless, the uncertainty and vagueness of a code having no logical arrangement is a serious hindrance to the proper enforcement of the building laws and makes for friction and controversy. The greatest objection is that defects in and omissions from the text are difficult to discover.

It is most desirable that the subject matter of the Boston building code be arranged in a logical and systematic manner suitable for the use of practicing architects and engineers.

Engineering Requirements. The allowable stresses, required loads and methods of design and calculation specified for steel, concrete, masonry, timber and other engineering materials are in general in accordance with good standard practice and are liberal rather than otherwise in most cases.

Egress Requirements. The requirements as to exits from theaters are definite and satisfactory. For apartments of small size, the requirements are adequate, but for all other types of buildings, the requirements are vague and unsatisfactory. For all practical purposes, the entire matter is left to the discretion of the Building Commissioner. It speaks well for the present commissioner as well as his predecessors in office that this feature of the code has not proved a source of serious friction. In the hands of an incompetent or dishonest official,

this feature might easily become a source of most arbitrary decisions. The difficulties encountered in formulating general requirements as to egress are recognized but no law can be a good law unless it states its requirements in reasonably definite and exact terms. Other cities have formulated rules for exits which are fair and reasonable and which permit architects to design buildings with the assurance that the building department cannot refuse arbitrarily to accept their egress arrangements provided they comply with the stated requirements. The builders of Boston are fairly entitled to more definite regulations as to exits and it is strongly recommended that the code be amended to include such provisions.

Fire Resistance Requirements. The Boston code recognizes three classes of buildings based upon resistance to fire. First class or so-called "fireproof" construction is defined rather vaguely and not in accordance with modern ideas. In Section 8, materials to be rated as "fireproof" must pass a four hour fire test differing considerably from the present American Standard fire test. In Section 32 (d) another definition of fireproofing is given which could be met by but one material. This definition also differs from modern practice.

Second class construction consists of masonry exterior walls and combustible or wooden interior, usually with open stairways. This construction offers little or no resistance to the internal spread of fire and is in sharp contrast to the rather exacting requirements of first class construction. No intermediate types of construction are recognized and no encouragement is offered for the use of the lighter and less expensive types of fire-resistive construction. Moreover, the heights allowed for second class construction are considerably greater than those allowed in other parts of the country, being 75 feet in the case of mercantile buildings and 65 feet for dwellings with the restriction that buildings over four stories must have "fireproof" first floors. In many of the larger cities this type of construction is limited to three or four stories.

Third class or frame construction is permitted a height of three stories although limited to two stories in nearly all other parts of the country.

To offset the unusual heights of second and third class construction, rather severe limits of area are placed on these buildings with the result that the tendency in Boston is to build a large number of small units, each relatively high considering the type of construction. Small units tend to be poorly operated and maintained. In units large enough to warrant a paid attendant, good housekeeping conditions can be maintained, while in small units maintained by odd-time labor of the owner or one of the tenants, poor housekeeping conditions are the rule.

The present zoning ordinance provides for side yards in the case of new dwellings, but there are some districts included in which mercantile occupancies

are permitted which are outside of the fire limits and here frame stores are built up to the lot line. Although the area of these buildings is restricted, there appears to be no restriction as to the number of them that can be built adjacent to each other on a single street.

In a city like Boston with much closely-built wooden construction, especially in its residential areas, there is a severe conflagration hazard. (See Fig. 148, chapter 8.) The provision of the code which has been in effect since 1914 requir-



A view of buildings in the general wholesale district of downtown Boston. Note their small unit areas. Only the taller buildings shown are of fire-resistive construction. Appropriate revision of the building code could in a few years so stimulate the use of fire-resistive construction that it would become as economical as second-class (brick and wood) construction for mercantile or industrial buildings, as is the case in other cities, like Detroit.

ing fire retardant roof coverings on all buildings in the city is an excellent one. This provision was added following the conflagrations in Salem and Chelsea, where wooden shingle roofs spread the fire with astonishing rapidity from roof to roof, and does much to reduce the conflagration hazard of many parts of the city. Since under this provision no new wooden shingle roofs are permitted to have been laid or replaced since 1914, they have practically been eliminated in Boston.

Administration. The method of administration given in the building code is quite satisfactory so far as the code itself is concerned. Certain statutes are now administered by the state authorities and this unfortunately leads to a division of authority and consequent confusion. There is no adequate reason why this work should not be entrusted to the local authorities.

A great improvement in Boston's system of building inspection would result from the creation of a metropolitan district for the inspection of buildings and such allied work as would be advantageous. Such a district should include all the cities and towns usually recognized as belonging to the Boston district and should be freed entirely from state interference other than the necessary legislation to sanction its basic regulations. It is interesting to note that the Metropolitan District of London (England) was organized by Act of Parliament in 1844 for this identical purpose. Previous to this Act, the building inspection and city engineering had been conducted by twenty-nine independent cities and towns. The results of this reorganization were unquestionably of the greatest benefit and might well be taken as an example for a metropolitan district of Boston.

WHAT THE BUILDING CODE IS DOING

The trend of building in Boston which has been sanctioned and crystalized by the building code is toward the construction of a large number of small frame three-story apartments, brick walled and wood interior apartments, and mercantile buildings six to seven stories high with very inadequate internal fire resistance, mostly in small units, and a few excellent fire-resistive buildings concentrated in the high value district. The first two groups of buildings (brick walled wooden and all frame) are certainly undesirable from a fire-resistive standpoint, while the third group is regrettably small in number. As long as the present regulations are in force, very little in the way of improvement may be expected. The zoning law places a maximum height limit in those sections of the city where three-family dwellings are constructed which coincides with the maximum allowed for frame apartments, while in the more congested districts, the zoning height again coincides with the limit for second-class (brick and wood) buildings. There is no incentive for a builder to use a better type of construction. The maximum of profit in investment appears to coincide with the minimum of quality in construction.

The high, second-class (brick and wood) buildings reveal a bad fire record, as would be expected, and the three-story frame buildings record is also poor. It must also be realized that the three-story frame buildings are in constant danger of conflagration.

The chief value of building laws lies in the degree of encouragement offered to the construction of better buildings. The present Boston code operates to discourage the erection of good buildings. To correct this unfortunate situation amendments should be sought as follows:—

First — Limit the height of frame buildings to two stories.

Second — Limit the height of combustible interior brick-walled buildings to three stories but increase the permissible area.

Third — Recognize at least one, but preferably two, intermediate types of fire-resistive construction for light occupancy buildings over three stories. A protected wooden construction (stairways enclosed and interior finished in metal lath and plaster, for example) suitable for resisting a one hour fire might be accepted in apartments and other light occupancies up to four or even five stories and fair areas, while a construction of incombustible materials suitable to resist a two hour fire might be accepted up to the maximum height allowed by the zoning ordinance and for fairly large areas.

Fourth — Adjust the height limits in the outer residential districts so that the limit for frame buildings will be one story less than the height limit permitted by the zoning requirements. In the next height district, the limit for brick buildings with unprotected interior construction should be one or two stories less than the maximum height allowed.

Fifth — In the congested high value district, a two-hour fire resistance should be required in all light occupancy buildings over one story in height and a four-hour resistance in all heavy occupancy buildings over one story in height.

Such regulations would make it profitable for a builder to use a type of construction better than the minimum required for the purpose by permitting him to go a story or more higher than the builder who uses the poorer type of construction. Already there appears to be a tendency to discontinue building the worst types of frame apartments so common in Boston and only a little encouragement would be required to induce builders to utilize better types.

OLD BUILDINGS

Boston, being an old city, has an unusually large number of old buildings, a great many of which according to modern standards were poorly built and are now in many cases in very bad repair. These buildings are responsible for an abnormal portion of the city's fire losses and present one of the most difficult

problems to the building department. Certain broad powers are conferred on the commissioner by sections of the code, particularly Section 4, which permits him to order certain changes such as are necessary to provide adequate egress from old buildings, and Section 5, which provides for securing and repairing structures which are dangerous, but nowhere in the code is there any *definite* power given the commissioner to remedy buildings which are unsafe from the fire viewpoint. Among existing defects are unprotected vertical openings and exposed timber. A portion of the building inspection force should be detailed exclusively to the reinspection of old buildings. It is believed that a properly conducted campaign of education in the matter of fire protection will convince the owners of these old buildings that their best interest lies in taking the necessary precautions to make Boston a better and safer city in which to live and work. ✓



Massed frame construction in Charlestown. Buildings such as these, highly combustible and extending many blocks without the interposition of even an occasional brick walled building, make sweeping fires possible, especially in Charlestown and East Boston, where such construction predominates.

WHARVES

The great number of timber wharves covered with sheds containing large undivided areas presents a serious hazard, especially because of the high value of goods commonly stored in these buildings. From the very nature of the construction, fire walls are out of the question in most of the existing wharves. Fire walls can be installed in new timber wharves. Sprinklers while in quite general

use elsewhere in the city have not been installed to any great extent in Boston wharf property. In the interest of the maintenance of Boston as a great and prosperous port, efforts should be made toward securing fire-resistive wharves and more fire-resistive buildings in place of the timber wharves and buildings now occupying the water front. Safe delivery of commodities is a growing factor in the selection of terminal routes by large shippers of goods to ocean ports.

PLANNING FOR THE FUTURE

The construction of fire-resistive buildings at reasonable cost is comparatively a new art but already it is possible to construct many types of fire-resistive buildings at a cost no greater or only slightly greater than the older combustible type. It requires little encouragement to induce builders to use fire-resistive materials once they are familiar with such construction but unfortunately Boston's building laws have tended to discourage rather than encourage the new types of construction except in the case of a few high buildings in the central district. In consequence, the number of fire-resistive buildings has remained very small. A wise modification of the code, planned with the purpose of encouraging better types of construction, would result eventually in stimulating a higher type of building and giving a great impetus to the building trades. The new buildings would be better and more permanent. The future of the city would be more firmly established and the danger of a devastating conflagration progressively decreased. The stability of a city lies largely in the value of its buildings and history has repeatedly proved that a city of wood does not endure.

RECOMMENDATIONS

A metropolitan district should be created to control the building inspection and allied functions in the Boston District.

The present building code should be rearranged in logical sequence for the convenient use of those governed by it.

Definite egress requirements for all types of buildings should be placed in the code.

The allowable height of frame and unprotected wood interior buildings should be reduced and the use of light fire-resistive construction be permitted.

CHAPTER 3

THE FIRE RECORD

A. COMPARISON OF BOSTON WITH LARGE CITIES OF UNITED STATES

Taking cities over 500,000 population in the United States, Table 60 shows their fire losses for 1927 and the average of the last 5 years and the last 10 years. This gives the relative amount burned (1) during the most recent year for which statistics are available; (2) during recent years, and (3) over a considerable period.

As the amount available to burn is generally proportional to the size of the city, we expect the largest cities to have the largest losses. Boston is fifth in total losses in 1927, and fourth for the 5 and 10 year periods.

Basis of Comparison. Properly to compare cities we should have an index of the relative amount that there is to burn in each. Then we could compare the amount burned each year to this index and say whether or not Boston, for instance, is burning a larger proportion of its burnable values than other cities. The amount available to burn, however, can only be shown by a study of the physical makeup of each particular city. It involves considerations of the number and kind of buildings, the hazards they house, the kind of residences and their congestion, the hazards of big manufacturing plants, oil or lumber storage and similar conditions.

Satisfactory municipal valuation estimates are not available, and assessed valuations have been proven unreliable.

It is fairly accurate, however, to compare the fire losses of cities on a per capita basis.¹ This is based on the assumption that for a given number of people there is a relatively equal amount of property to burn in each city. Where a per capita loss figure based on a number of years is taken, it has proven a reliable index of the relative fire record of cities under comparison. Accordingly the large cities are arranged in Table 62 A on the basis of their 5-year average per capita loss figures, showing that Boston has by far the worst fire record. (See also Fig. 61.)

One factor that should be mentioned is that the figures quoted are not all compiled on the same basis, although all are the figures reported by the cities listed to the Committee on Statistics of the National Board of Fire Underwriters, which publishes these figures annually. The figures for Boston, Baltimore, Philadelphia and to a large extent those of Detroit, and those of Chicago for the

¹ Readers are referred to an article, "The Value of Per Capita Statistics," by Horatio Bond, in the Quarterly of the National Fire Protection Association for January, 1927.

years 1926 and 1927, are based on insurance losses paid plus an estimated allowance for uninsured losses. These are relatively reliable figures. Most of the other cities use estimates of fire officers, in some cases checked against adjusted losses, but of varying degrees of accuracy.

TABLE 60
FIRE LOSSES IN LARGE CITIES OF UNITED STATES

CITIES OVER 500,000 POPULATION Losses in Thousands of Dollars	1927	5-Year Average, 1923-1927	10-Year Average, 1918-1927
New York.....	19,820	19,942	18,464
Chicago.....	13,630	10,426	8,845
Detroit.....	5,710	4,285	3,668
Philadelphia.....	4,230	5,824	5,791
Boston.....	3,695	5,065	4,118
St. Louis.....	2,582	2,892	3,012
Cleveland.....	2,330	2,331	2,302
Pittsburgh.....	2,280	2,040	1,850
Los Angeles.....	2,000	1,922	1,520
Buffalo.....	1,930	2,534	2,069
Baltimore.....	1,737	1,982	2,308
San Francisco. (Does not compile loss figures.)			

Figures as reported to National Board of Fire Underwriters.

A fairer comparison, therefore, would be Boston with Philadelphia, Baltimore and Detroit, on which 5-year average loss figures are available, the figures involved in these cities being really comparable. (See Table 62 B and Fig. 61.) Baltimore is a good city for comparison with Boston because it is an old city and of about the same population. For comparison with Philadelphia and Detroit a figure for Metropolitan Boston is appended based on the losses reported by Boston plus those of the 15 cities over 20,000 population in greater Boston. The losses reported by these 15 cities are in many cases estimates only, so it is likely that if insurance losses were uniformly compiled that the figure for Metropolitan Boston would be even higher than that given.

Table 62 B shows that Boston has a fire loss approximately the same as Philadelphia and Detroit, both cities between two and three times as big as Boston. It has over twice the loss of Baltimore, a city of about the same population.

That Boston's loss is due to its being the high-valued center of a much larger metropolitan district is suggested. But the figure for Greater Boston in

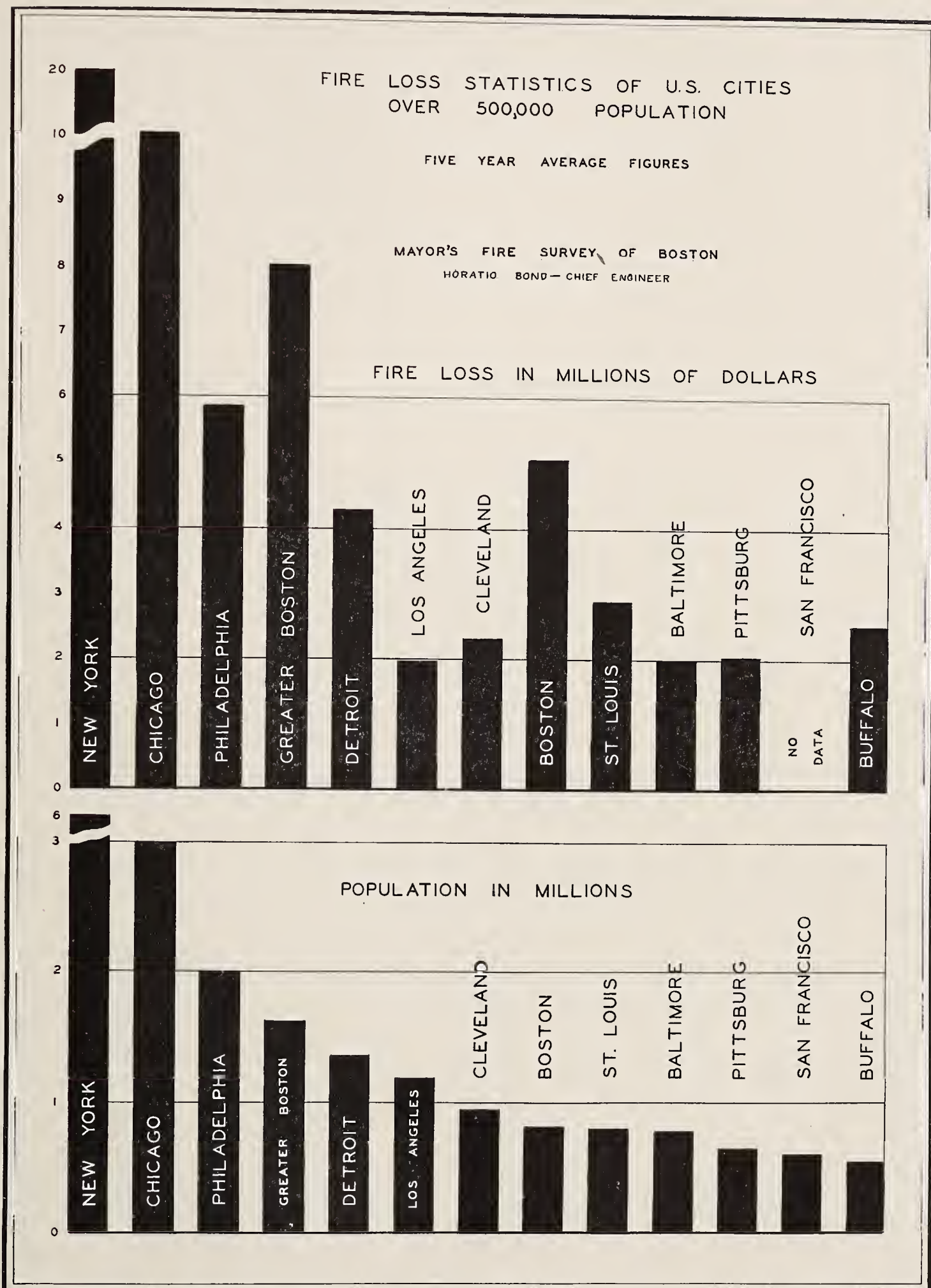


FIGURE 61.

TABLE 62 (A)
FIRE LOSSES OF LARGE CITIES OF UNITED STATES
5 years, 1923-1927, inclusive

CITIES OVER 500,000 POPULATION	Average Population (Thousands)	Average Annual Fire Loss (Thousands of Dollars)	Per Capita Loss (Dollars)
Boston.....	805	5,065	6.30
Buffalo.....	545	2,534	4.65
St. Louis.....	800	2,892	3.61
Chicago.....	3,000	10,426	3.50
New York.....	6,000	19,942	3.32
Pittsburgh.....	640	2,040	3.19
Detroit.....	1,370	4,285	3.12
Philadelphia.....	2,000	5,824	2.91
Baltimore.....	792	1,982	2.50
Cleveland.....	940	2,331	2.48
Los Angeles.....	1,200	1,992	1.65
San Francisco.....	600	No data	—

TABLE 62 (B)
STATISTICS OF LARGE CITIES WITH FIRE LOSS DATA COMPARABLE TO BOSTON
5-YEAR AVERAGE FIGURES: 1923-1927

	Population (Thousands)	Annual Loss (Thousands of Dollars)	Per Capita Loss (Dollars)
Boston.....	805	5,065	6.30
Baltimore.....	792	1,982	2.50
Philadelphia.....	2,000	5,824	2.91
Detroit.....	1,370	4,285	3.12
Metropolitan Boston ¹	1,595	8,126	5.10

¹ Cities of Cambridge, Somerville, Lynn, Quincy, Newton, Malden, Medford, Chelsea, Brookline, Everett, Waltham, Revere, Watertown, Arlington and Melrose, a total population area of about 811,000 average population 1923-1927, added to Boston proper with a population of 784,000 for the same period, give a metropolitan area comparable to that of Philadelphia and Detroit of about 1,595,000 population. The loss figure is the sum of those reported by these cities to the National Board of Fire Underwriters. See Appendix 8.

Table 62 B shows that the fire loss is nearly twice that of the roughly comparable metropolitan areas of Detroit and Philadelphia.

Boston has features that would tend to cause high losses — an unusual amount of manufacturing and storage in buildings of combustible construction, for instance. A subsequently presented part of this study shows that Boston has a high loss in residence buildings. But do these factors entirely explain why Boston should have such a disproportionate fire loss when compared with cities like Baltimore, Philadelphia and Detroit?

Any way the situation is looked at, it prompts the conclusion that Boston's fire loss record has been very high, and that the same factors that make the loss high in Boston proper, are at work in Greater Boston as well. Boston obviously has been burning a much larger amount of its burnable values than is necessary.

B. ANALYSIS OF PUBLISHED FIRE RECORD DATA

In general, the published fire record data are very unsatisfactory. As to number and kind of fires, the Fire Department annual reports give fair statistics, but the classification of fires leaves much to be desired. The loss figures published by the Fire Department are those of the Boston Protective Department.

Number of Alarms. During the ten years 1918–1927, the annual number of alarms has increased from 5,062 in 1918 to 7,332 in 1927. The lowest record in this period was 4,485 in 1920 and the highest 7,993 in 1924. The Fire Department must answer over 2,000 more alarms now than ten years ago.

This increase, as shown by Fig. 64, is due in the main to an increased number of fires of all kinds, but principally by an increase in the number of outdoor fires — in brush or rubbish. As will be shown later, these outdoor fires are largely dependent on weather conditions in a given year, which will account, for example, for there being 1,239 more such fires in 1923 than in 1920. Automobile fires have increased steadily from 142 in 1918 to 583 in 1927.

The false alarm record in 1927 is not much worse than 1918, but three low record years, 1920, 1921 and 1922 show that false alarms can be kept at a much lower figure than those shown for most of the last ten years. The figures for 1928, of which a special study has been made, were decidedly abnormal, being more than twice the 1927 figure.

Occupancy Data. The annual reports of the Fire Prevention Division of the State Department of Public Safety are not of much additional assistance, for while an attempt is made there to give the number of fires and amount of loss by occupancy in Boston, the occupancies given are so general that the figures are meaningless. For instance, dwelling fires, except for fires in stores and dwellings

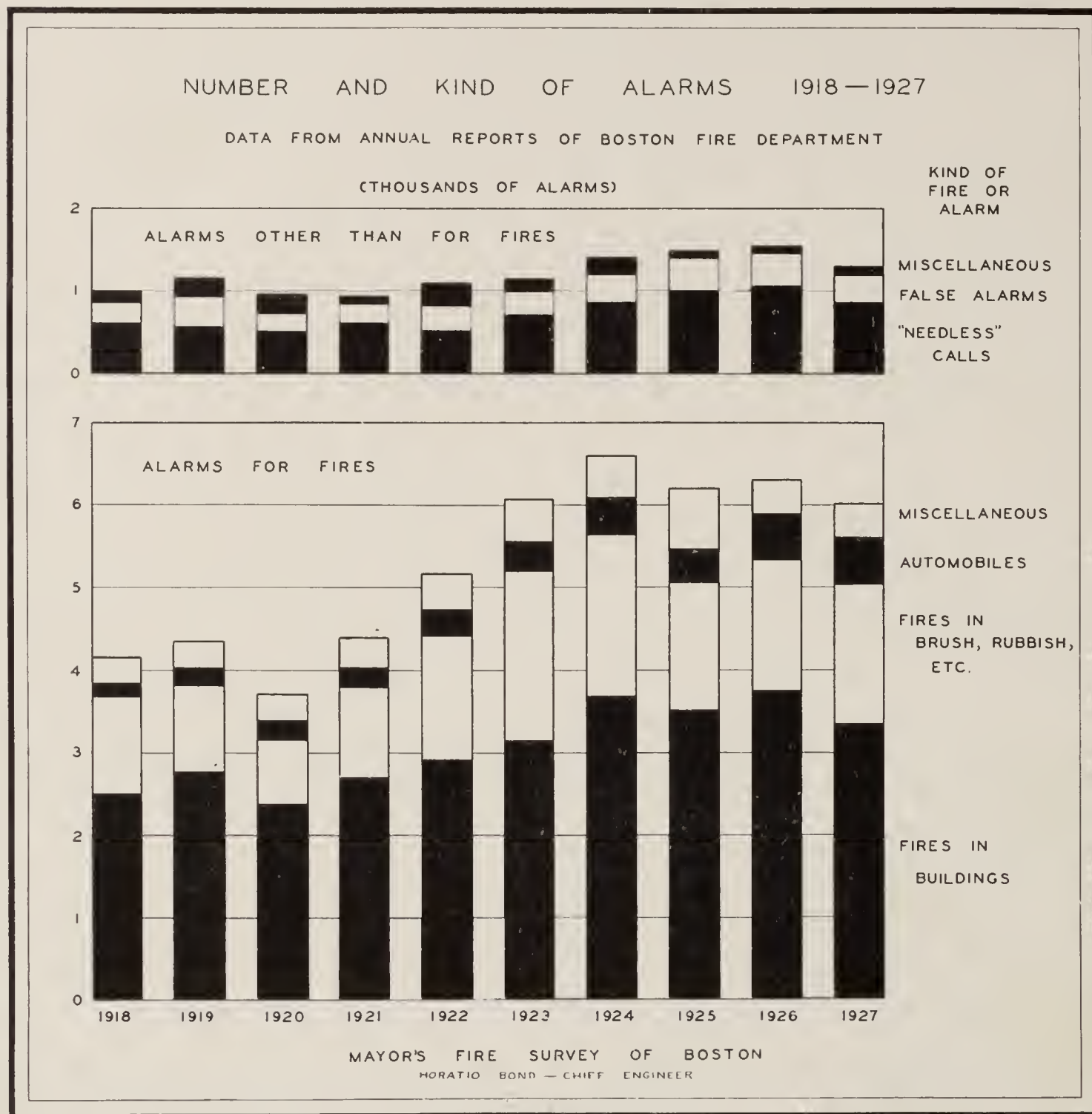


FIGURE 64.

See also Appendices 3A and 3B.

and lodging houses, were lumped in a single class, with no data as to the size of the building, or whether one or two-family private residences, or apartments housing numerous families. Storehouses and warehouses of all kinds were lumped, as were factories and workshops, with no data as to trade or type of manufacture involved. Retail stores were practically all in an "unclassified" group. The lack of precise occupancy data in this classification is not the fault of the Department of Public Safety in making the classification, but is due to lack of data on fire reports forwarded to that department. It can be argued, however, that the

department might insist on more detailed reports from the Boston, and other Massachusetts fire departments, which would enable it to keep this table properly.

The best published statistics are those of the Boston Protective Department. In the annual report of that organization is fairly detailed loss data, showing the proportion of loss "covered by insurance" and an estimate of losses on uninsured properties together with data on miscellaneous minor losses, like those on rent insurance, and sprinkler leakage. They contain a fair summary of data on the performance of automatic sprinklers. A summary of the number of alarms in the city by districts, by months, by day of week and hour of the day is given.

TABLE 65
NUMBER OF FIRES AND AMOUNT OF LOSS BY SIZE OF FIRE 1927
From Annual Report of Boston Protective Department

NUMBER OF FIRES	Size	Loss	Per Cent.
4,810.....	No Loss.		
957.....	Loss under \$100.....	\$37,298.11	1.0
792.....	\$100 to \$500.....	182,514.85	4.9
211.....	\$500 to \$1,000.....	149,481.39	4.1
397.....	\$1,000 to \$5,000.....	899,112.68	24.3
75.....	\$5,000 to \$10,000.....	512,740.09	13.9
19.....	\$10,000 to \$15,000.....	226,657.01	6.1
44.....	Over \$15,000.....	1,686,837.56	45.7
7,305.....		\$3,694,641.69	100.0
11.....	Marine Losses.....	232,730.93	
7,316.....		\$3,927,372.62	
	Rent Losses.....	9,957.16	

Size of Fire. The most useful table in the annual reports of the Protective Department is one giving the number of fires and relative size of the individual fire loss. This table also contains a list of all the fires with loss over \$15,000 during the year. Table 65 gives the 1927 figures, together with a column showing the per cent. of loss attributable to each size of fire. In Table 66 the percentages for each of the last 10 years are given.

The proportion of the total loss due to the fires with losses over \$15,000 was in 1927 the smallest in ten years. (See Table 66.) As the fires over \$15,000

TABLE 66
FIRES WITH LOSS — PER CENT. OF LOSS BY SIZE OF FIRE
From Records of Boston Protective Department
(Excluding Marine and Rent Losses)

Loss	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Under \$100	1.1	1.4	0.9	0.8	1.0	0.6	0.8	0.7	0.8	1.0
\$100-\$500	4.2	5.4	4.0	3.5	4.5	2.5	3.8	3.5	3.4	4.9
\$500-\$1,000	2.8	4.5	3.1	2.8	4.0	1.7	3.4	3.0	3.6	4.1
\$1,000-\$5,000	14.8	19.0	16.0	12.6	19.7	11.3	18.6	16.3	18.3	24.3
\$5,000-\$10,000	7.0	9.1	8.6	8.7	12.0	8.5	14.9	13.0	11.9	13.9
\$10,000-\$15,000	3.9	6.5	5.2	7.2	6.4	6.6	9.5	6.9	9.4	6.1
Over \$15,000	66.2	54.1	62.2	64.4	52.4	68.8	49.0	56.6	52.6	45.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

loss have annually accounted for nearly 60 per cent. of the losses this reduction is significant. It is accompanied by a marked increase in the number of fires with losses between \$1,000 and \$5,000.

The only known factor that can account for this reduction of big fires in 1927, has been a conscious effort on the part of the Fire Department to "make little fires out of big ones." This has been accomplished by faster response, quicker pulling of multiple alarms on big fires and generally improved efficiency.

Other Reported Loss Figures. In addition to fire losses on buildings and contents, the losses on ships and vessels or marine losses are reported. These were \$232,730 in 1927, but have averaged \$70,000 a year in the last 10 years, the losses being due in the main to a few large fires. Marine losses are generally omitted in comparing the losses of cities, as they are ordinarily beyond the control of the city.

Rent losses are paid only where insurance is carried against loss of rents on property destroyed by fire. The amounts paid are relatively trivial, being \$9,957 in 1927, and averaging less than \$15,000 annually.

Fire Department Uses Protective Department Loss Figures. For their official records the Boston Fire Department uses the Protective Department figures. What is actually done is this: At the time of reporting the fire, the District Chief puts down his estimate of the loss. Later a clerk in the Fire Prevention Division takes this report to Protective Department headquarters, and, when the loss has been adjusted, enters on the report the Protective Department figure for the loss on buildings and contents. Marine losses are also entered, but no attention is paid to rent losses or to losses due to sprinkler leakage or water damage where there was no fire.

The Protective Department figures are the actual losses paid on the fire by the insurance companies plus an estimate or a calculation of "uninsured loss." These uninsured losses include only about 5 per cent. of the total losses so are not particularly important, but a discussion of how these are arrived at is given in Appendix 3 D.

Sprinkler losses (due to leakage where there is no fire) amounted to \$20,929.27, as reported, and have averaged about \$28,000 annually. A small figure for water damage other than in fires is also reported. This was \$7,862 in 1927.

Appendix 3 C summarizes these losses for 10 years.

THE 1928 FIRE RECORD

Figures on losses in 1928 were not available when the main part of this study was being made. They became available with the publication of the annual report of the Boston Protective Department early in March. Brief comments on these figures, together with figures on the number of fires furnished by the fire department is given here. The 1928 figures serve to substantiate conclusions drawn on the basis of the figures through 1927.

Number of Alarms. Fig. 64 (and Appendices 3 A and 3 B) gives the Fire Department records of the number of alarms by types. The corresponding 1928 figures follow:

ALARMS		ALARMS FOR FIRES	
Alarms for Fires.....	5,795	Fires in Buildings.....	3,348
"Needless" Alarms.....	921	Fires in Brush, Rubbish, etc.....	1,440
False Alarms.....	883	Automobile Fires.....	631
Other Alarms.....	97	Other Fires.....	376
Total Alarms.....	7,696	Total Fires.....	5,795

The increase of 364 alarms over the 1927 record is more than accounted for by the epidemic of false alarms, discussed in Chapter 5. False alarms jumped from 314 in 1927 to 883 in 1928. The number of fires in buildings has been further slightly reduced.

Size of Fire. Referring to Tables 65 and 66, the following tabulation, made from the annual report of the Boston Protective Department, give the same data as to size of fire in 1928.

These loss figures show that the percentage of large fires (over \$15,000) has remained practically constant during the last two years, at about 46 per cent. It has already been pointed out (Table 66) that this class of fire has, in previous years, averaged nearly 60 per cent. of the total losses, and the continued good record in 1928 indicates that the same factors, which brought about the reduction in 1927 are still at work in the city. Similarly the 1928 figures show that the number of large fires was less than in 1927, and that this decrease in large fires is accompanied by an increase in the per cent. of loss in fires with losses between \$1,000 and \$10,000.

NUMBER OF FIRES AND AMOUNT OF LOSS BY SIZE OF FIRE, 1928

NUMBER OF FIRES	Size	Loss	Per Cent.
5,143.....	No Loss.		
956.....	Loss under \$100.....	\$36,791.52	1.0
778.....	\$100 to \$500.....	175,881.74	4.5
228.....	\$500 to \$1,000.....	161,482.52	4.1
365.....	\$1,000 to \$5,000.....	807,726.80	20.8
88.....	\$5,000 to \$10,000.....	628,193.78	16.2
24.....	\$10,000 to \$15,000.....	292,546.44	7.5
38.....	Over \$15,000.....	1,784,626.71	45.9
7,620.....	Total.....	\$3,887,249.51	100.0
12.....	Marine Losses.....	34,782.78	
7,632.....		\$3,922,032.29	
	Rent Losses.....	17,277.13	
		\$3,939,309.42	

This decrease in large losses shows that a material improvement has been started, and that additional effort is necessary to obtain a further reduction in losses of all kinds.

CONCLUSIONS REGARDING PUBLISHED FIRE RECORD DATA

The available fire record data as compiled by existing agencies is not adequate for the present study. Fires are not sufficiently well classified and data as to occupancies involved is almost totally lacking, and the record is otherwise defective. Accordingly the detailed fire record studies presented in the rest of this chapter and the two following had to be made.

C. WHAT IS BURNING IN BOSTON

CLASSIFICATION OF FIRES AND ALARMS

Different means of attack must be employed to control different kinds of fires and accordingly they must be classified for study to develop an appropriate means of control for each type.

Some alarms answered by the Fire Department, like false alarms, are of importance only in causing unnecessary running of fire apparatus and resulting danger to persons on the streets and a lessening of protection while apparatus is needlessly out of the station. Building fires on the other hand usually involve some loss.

It is desirable to reduce both the *number* of alarms and the loss. If the number of runs can be materially reduced, less apparatus will be necessary to protect the city. Reduction in losses on individual fires will improve the city's fire record.

The following classifications include fires of similar characteristics susceptible to similar methods of control.

Fires in and around Buildings.

(a) **RESIDENCE BUILDING FIRES.** Includes apartments, tenements, dormitories and lodging houses, places where people live. In this group are also fires where the fire started in the residential part of store-and-dwelling buildings.

(b) **FIRES IN OTHER BUILDINGS.** Includes mercantile and manufacturing buildings, hotels, fraternity houses, clubs and all other buildings whose occupancy is not strictly residential. It includes stores-and-dwelling buildings, when the fire started in the store part. This class covers all buildings where there are hazards of manufacturing processes or the storage of merchandise.

(c) **FIRES IN RUBBISH OUTSIDE OF BUILDINGS.** These fires are taken up in connection with fires in buildings, because the rubbish accumulations in which they originate are incidental to the building, and can or should be controlled by the occupants. This class of fire does not contain any involving fire loss. If a fire started in rubbish outside and spread to the building, damaging it, it was considered as a building fire.

(d) **FURTHER CLASSIFICATION OF FIRES IN BUILDINGS.** In addition to being classified as to residential or other occupancy, the fires in buildings were further subdivided for convenience in study. First, **CHIMNEY FIRES**, the burning of soot in dirty chimneys, were separated from the rest. These were considerable in number, but the losses were trivial. Second, the fires were grouped according to the amount of loss. Loss figures used were those reported by the Boston Protective Department as entered on the Boston Fire Department reports.

Grass and Brush Fires. This classification involves only fires in grass and brush as distinct from fires in rubbish, regardless of whether the fires occurred in vacant lots or elsewhere. This does not include fires involving any fire loss.

Fires in Dumps and Vacant Lots. This includes fires in dumps and in rubbish accumulations in vacant lots. As the material burning is in most cases of no value, this classification contains only no-loss fires.

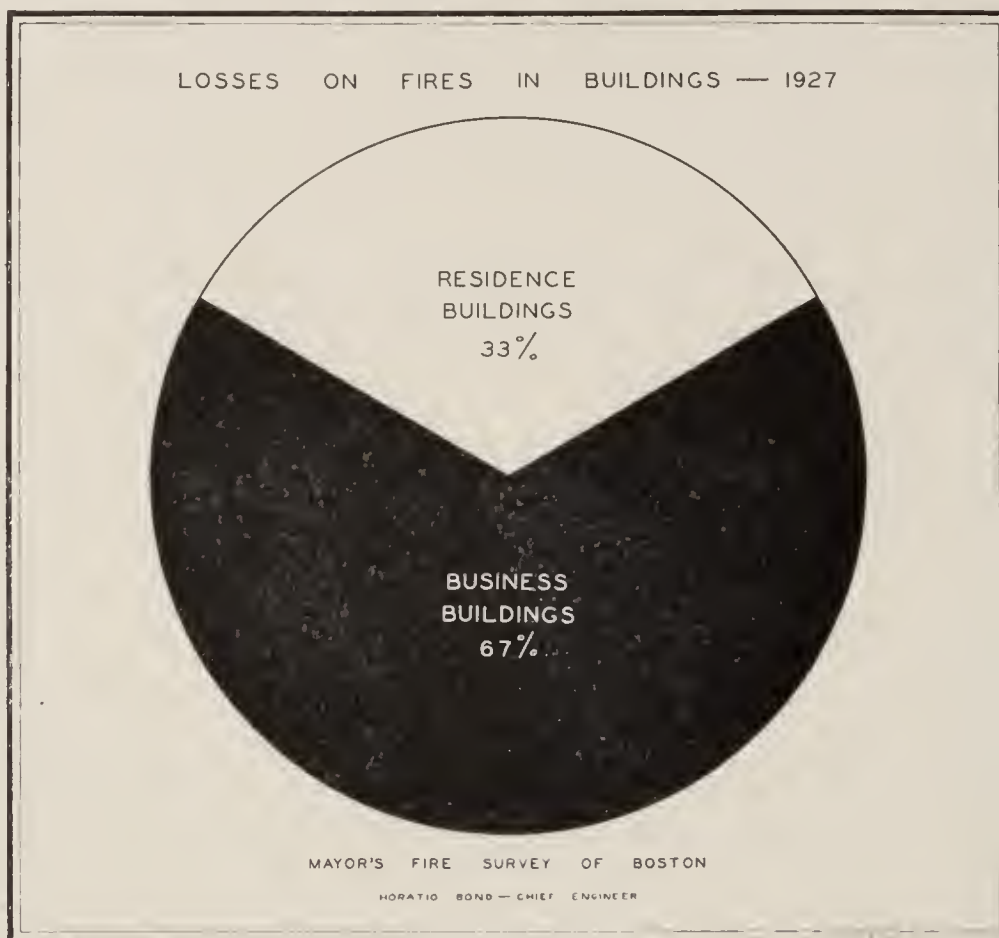


FIGURE 70.

From Table 72.

Miscellaneous Fires Outdoors. This includes fires in bridges, billboards, telephone poles, fences, and other structures which cannot be accurately classified as fires in buildings. For convenience any fires starting as a brush or grass fire, or as a fire in a dump or vacant lot, which does any damage for which a loss is paid, is included in this classification.

Marine Fires. This includes fires in vessels and boats.

Automobile Fires. Fires in automobiles on the street or outdoors. The few fires in automobiles in garages were put in the "Fires in Buildings" class.

Calls Where There Was No Fire. This includes "needless" alarms, where smoke, steam or a light was mistaken for a fire, calls for emergencies involving rescue work, and other miscellaneous calls. None of these calls involved any fire loss.

Accidental Alarms. Includes accidental alarms from automatic sprinkler or automatic fire alarm systems only. Any other alarms that might be considered accidental are included in the class, "Calls Where There Was No Fire."

False Alarms. Includes deliberate false alarms from fire alarm boxes and a few false "still" or telephone alarms.

CLASSIFICATION OF FIRES AND ALARMS IN THE 1927 RECORD.

There were 7,332 alarms in 1927, which gave a reasonable amount of data for study purposes. The work involved in analyzing these 7,332 alarms was considerable and while it would be desirable to have a record over a longer period than a year the time available for this study did not permit of analyzing more than a single year's record. However, in the case of fires in buildings a five-year study of sprinkler fires and fires with loss over \$15,000 was made. The 1927 record of grass and brush fires was compared to 1926 and a special study of false alarms was made for 1928 as well as 1927.

TABLE 71
CLASSIFICATION OF ALARMS 1927

	Number of Fires	Per Cent.	Number of Fires	Per Cent.
Residence Building Fires.....	1,984	27.1		
Other Building Fires.....	1,404	19.3		
Fires in Rubbish Around Buildings.....	244	3.3		
Fires in or Around Buildings.....			3,632	49.7
Grass and Brush Fires.....	864	11.7		
Fires in Dumps and Vacant Lots.....	615	8.4		
Miscellaneous Fires Outdoors.....	210	2.8		
Outdoor Fires.....			1,689	22.9
Automobile Fires.....			608	8.3
Marine Fires.....			24	0.3
Total Fires.....			5,953	81.2
Calls Where There Was No Fire.....			863	11.8
False Alarms.....			370	5.0
Accidental Alarms.....			146	2.0
Total Alarms.....			7,332	100.0

Tables 71 and 72 show the distribution of alarms and losses by classes in 1927. They show that building fires account for only about half of all alarms. Outdoor fires represent nearly one quarter of the rest, the remaining quarter being for marine fires, automobiles, "needless" and emergency calls, and false or accidental alarms. Practically all of the losses however are in buildings.

TABLE 72
DISTRIBUTION OF FIRE LOSS 1927 BY KIND OF FIRE

	Loss	Per Cent. of Loss
Residence Building Fires.....	\$1,209,229	32.7
Other Building Fires.....	2,447,918	66.2
Total Loss in Building Fires.....	\$3,657,147	98.9
Miscellaneous Fires Outdoors.....	5,747	0.2
Automobile Fires.....	31,747	0.9
Total Loss.....	\$3,694,641	100.0
Marine Fires.....	232,730 ¹	

¹ The loss on marine fires is not totaled in with the other losses as these are usually due to fire hazards outside of the control of the city, and the losses are not fairly chargeable against the city's fire record.

The Boston Protective Department also reports the following losses paid in 1927 which are not included in the above table: Losses paid on rent insurance, \$9,957; sprinkler leakage losses, \$20,930; losses paid due to other water damage other than in fires, \$7,862. These are all relatively minor items. (See Appendix 3 C.)

CHAPTER 4

FIRES IN BUILDINGS

The classification of alarms and fires for a typical year (Tables 71 and 72) has shown that practically all the fire losses in Boston occur from fires in buildings. These fires have therefore been carefully studied and an attempt has been made to evaluate, among others, the following factors:

- (a) General type of building or occupancy.
- (b) Construction of the building.
- (c) Automatic sprinkler protection.
- (d) Losses by specific occupancies.
- (e) Exposure.
- (f) Cause of fire.
- (g) Time of day when fire occurred.
- (h) Part of city in which fire occurred.

Original Data. The source of information for this study had to be largely the reports of individual fires by the Fire and Protective Departments. It was found that the information recorded on the fire report blanks filled in by the district chiefs of the Fire Department was in itself meagre as regards all of the above factors, except that the address where the fire occurred and the time of day the alarm was received at fire alarm headquarters were given.¹ By checking the separate reports of the Fire and Protective Departments on each fire fairly accurate data as to occupancy was obtained. The data as to how the fire started and spread, necessary for the study of the factors of building construction, exposure and the cause of the fire, was generally inadequate.

Because of the time required to compare and check the original data, it was obviously not feasible to make a detailed study of all fires for a period of more than one year, but such close study was given of the 3,632 fires in and outside around buildings during 1927.

This was supplemented by a careful analysis of the 283 fires with losses over \$15,000 which have occurred in the five years 1923–1927. These 283 fires accounted for \$14,145,000 of the \$25,324,000 total losses in these five years, or 56 per cent.

The best fire reports available were those on fires in property equipped with automatic sprinklers, as made by the Boston Board of Fire Underwriters on the standard fire report blanks of the National Fire Protection Association.² These contained reliable and complete data on 952 fires between October, 1924,

¹ See Fig. 187, Chapter 11, for an illustration of this blank.

² See Fig. 193, Chapter 11.

and October, 1928, limited however to a protected class of property. They made possible, nevertheless, a detailed study of the effectiveness of automatic sprinklers in each type of occupancy.

The inherent limitations of each record should be borne in mind in the discussions which follow. As they supplement each other, however, these three separate fire records have provided a fairly satisfactory basis for this study of fires in buildings.

GENERAL TYPE OF BUILDING OR OCCUPANCY

Residence Fires. The following table is an analysis of fires in residence buildings, 1927.

RESIDENCE BUILDING FIRES, 1927	Number of Fires	Loss
Fires with loss.....	1,185	\$1,208,775
"No Loss" fires.....	554	—
Chimney fires.....	245	454
Totals.....	1,984	\$1,209,229

For this study the "No Loss" fires are disregarded and the chimney fires are briefly discussed later.

A further analysis of the fires in residence buildings in 1927, according to their general type, gave the following table:

RESIDENCE FIRES, 1927, BY TYPE OF BUILDING (See also Fig. 75)

TYPE OF BUILDING	Number of Fires	Loss
Frame, 3 stories or above.....	390	\$324,530
Brick, 4 stories or above.....	330	¹ 432,717
Frame, 2 or 2½ stories.....	238	220,835
Brick, 3 stories.....	196	200,304
All others.....	31	30,389
Totals.....	1,185	\$1,208,775

¹ In this figure is a \$130,000 fire in a four-story brick private residence which is not typical of the other buildings included in this group, which are mostly apartments. Omitting this fire, the figures would be for this group, number of fires, 329, loss, \$302,717.

In the above table, the "four-story brick or above" class includes largely losses in apartments and tenements. The "three-story brick" class, generally

speaking, includes losses in apartments only. The "three-story frame" class indicates the losses experienced in the so-called "three deckers." The "frame two or two and one-half story" class includes mainly private residences. In the fifth class are contained those losses which could not be assigned to any one of the other general types of residence building.

Two large fires swelled the loss in the "four-story brick" class, a \$62,000 fire in an apartment house on Bartlett Street, and a \$130,000 fire in a private residence on Bay State Road. Since the latter residence is not exactly germane to the rest of this group, in which apartments predominate, it would be fairer to omit this one fire from that group in comparing it with the others. As the record is for a single year the one \$62,000 fire probably tends to exaggerate the relative amount of loss in this class also.

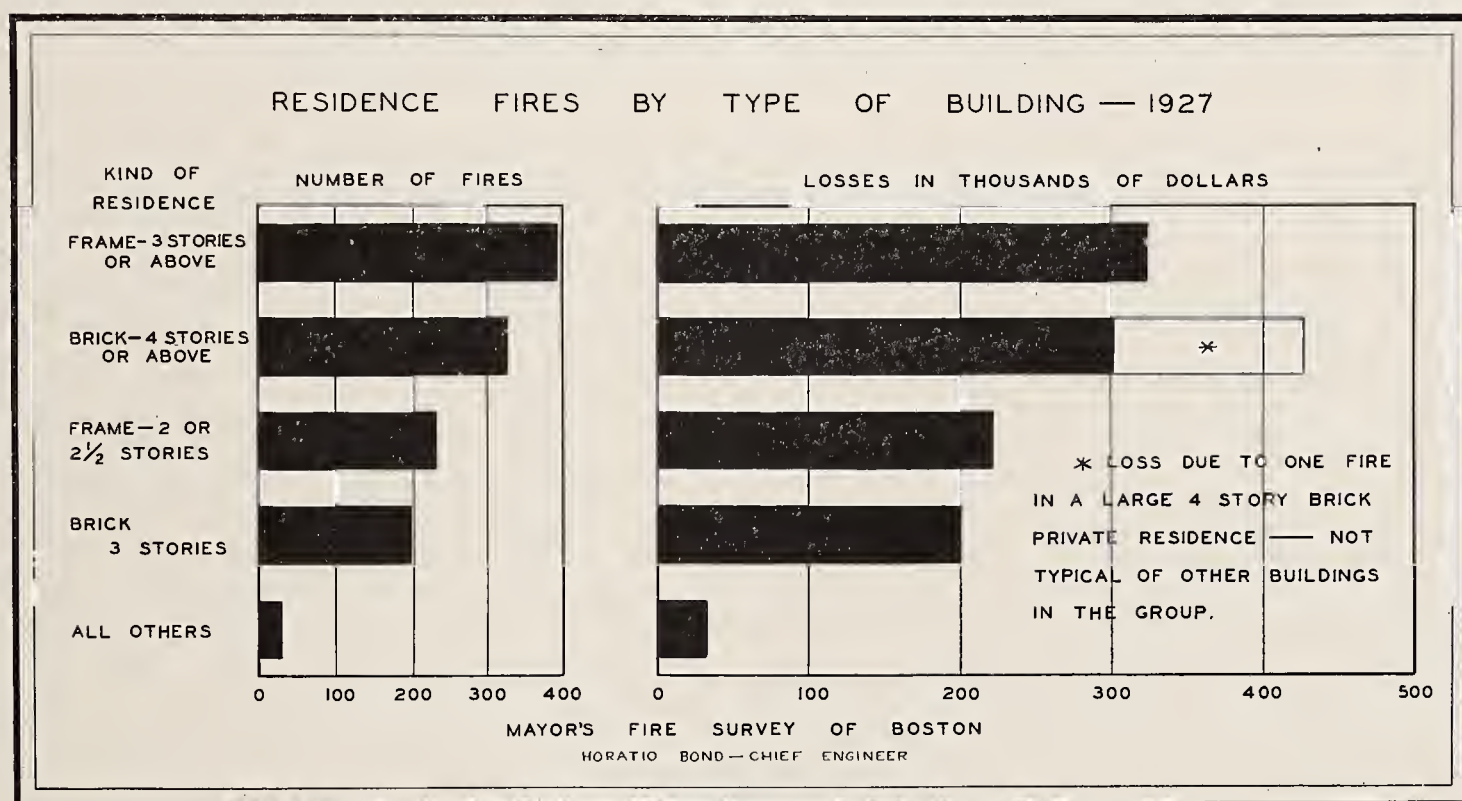


FIGURE 75.

The "three-decker" class has the largest number of fires. The loss is also largest in the "three-decker" class if the one large fire in a private residence is omitted from the "four-story brick" class.

Other significant observations are that residence fires cause approximately one-third of the total loss in fires in buildings, and that of the \$1,200,000 total loss in residence buildings in 1927, \$950,000 or nearly 80 per cent. was in multiple-tenant residences. The significance lies in the fact that while it may not be legal for the Fire Department to inspect one-family private residences, there is no question of its right to inspect the cellars and hallways of buildings where the safety of more than one family is involved.

The five year record of fires with losses over \$15,000 (Table 84) shows 26 fires in dwellings and apartments with losses totaling \$956,000 or an average of \$191,000 a year, which indicates that the losses in residence buildings are for the most part due to many small fires.

As dwellings equipped with automatic sprinklers are almost unknown, the five year record of fires in buildings equipped with sprinklers can furnish information only on apartment houses. (See Table 87, page 87.) There is a considerable number of sprinklered apartments, but in many of these the building is only partially equipped, there being sprinklers in basements, hallways and kitchens only. There were only three fires in sprinklered apartments where the loss exceeded \$4,500 and in each case the fire started in an unsprinklered portion. The average loss in the other 65 fires in sprinklered apartments was less than \$200, a low figure. This is significant, as we can see from Table 84 (page 84) that there were 13 large fires in unsprinklered apartments, totaling \$433,000.

Most of the fires in sprinklered apartments started in the basement, which together with the good record of sprinklers in apartments, demonstrates the wisdom of the laws and regulations calling for sprinklers in the basements and corridors of new apartments.

Fires in Non-Residential Buildings. The following table is an analysis of fires in non-residential buildings during 1927.

FIRÉS IN NON-RESIDENTIAL BUILDINGS, 1927	Number of Fires	Loss	Per Cent. of Loss
Fires with Loss over \$500.....	375	\$2,356,798	96.3
Fires with Loss under \$500.....	387	90,968	3.7
"No Loss" Fires.....	549		
Chimney Fires.....	93	152	
Total.....	1,404	\$2,447,918	100.0

For the purpose of this study the "No Loss" Fires and those with loss less than \$500 could be disregarded as the remainder accounted for nearly all the losses (96 per cent.). Chimney fires are treated briefly later.

The following table presents an analysis of fires with loss (except chimney fires) in non-residential buildings according to the general type of building involved. No attempt has been made to differentiate between tenant mercantile and tenant manufacturing as the original reports were not sufficiently clear on this point. The figures for 1927 alone indicate, however, that the multiple tenant occupancy experiences in a typical year over half of the losses in non-residential buildings.

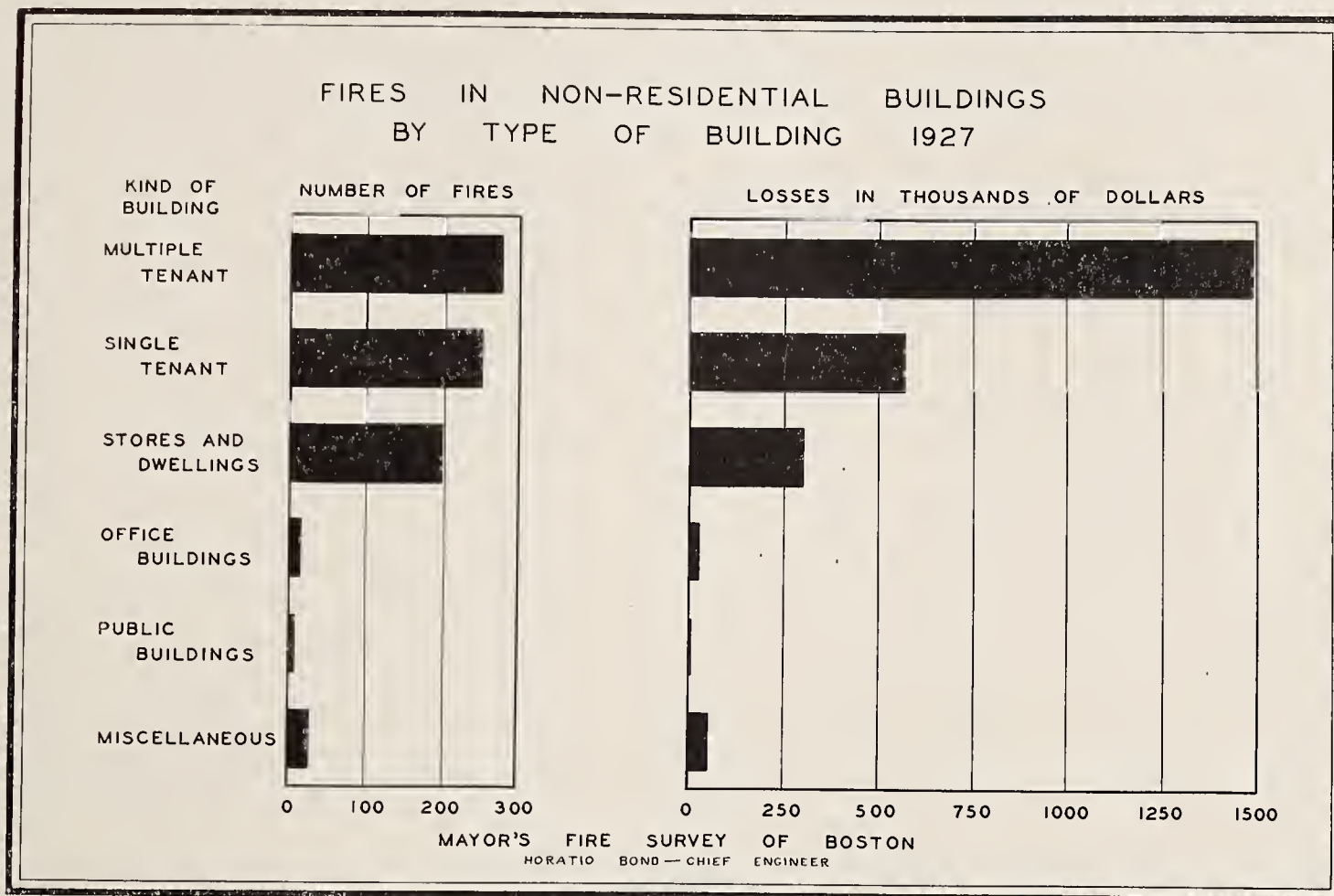


FIGURE 77.

The loss of approximately \$305,000 in the "stores and dwellings" group is entirely due to fires originating in the stores, this fact having been carefully established. The loss per fire in this group is \$1,540 whereas the average loss per fire in residence buildings alone is only \$1,020.

FIRES IN NON-RESIDENTIAL BUILDINGS BY TYPE OF OCCUPANCY, 1927
(See also Fig. 77)

TYPE OF BUILDING	Number of Fires	Loss
Multiple Tenant.....	265	\$1,492,417
Single Tenant.....	247	568,811
Stores and Dwellings.....	198	305,153
Office Buildings.....	14	25,454
Public Buildings (Schools, Churches, etc.).....	10	4,390
Miscellaneous.....	28	51,541
Totals.....	762	\$2,447,766

While the labor involved in accurately determining the type of building and occupancy was prohibitive as far as all fires were concerned, such data was carefully determined for the 283 fires 1923-1927 with losses over \$15,000. These fires by general classifications are summarized below.

FIRES WITH LOSSES OVER \$15,000, 1923-1927

GENERAL TYPE OF OCCUPANCY	Number of Fires	Loss	Per Cent. of Loss
1. Mercantile (mostly tenant) ¹	97	\$7,136,442	50.4
2. Warehouses	12	671,627	4.8
3. Manufacturing (single tenant)	24	1,354,749	9.6
4. Tenant Manufacturing	78	2,525,504	17.9
5. Miscellaneous	72	2,456,722	17.3
Totals	283	\$14,145,014	100.0

¹A "tenant" building is one occupied by more than one tenant (usually several). The building may be devoted to mercantile or manufacturing operations or both and may be limited to one trade group (as clothing dealers) or may have a mixed trade occupancy. In any case the predominating occupancy determined the classification above into which the fire was put.

Over half of the losses in large fires are in the mercantile classification, tenant manufacturing being second.

A similar analysis of the losses in all fires in properties equipped with automatic sprinklers is given below.

FIRES IN PROPERTY EQUIPPED WITH AUTOMATIC SPRINKLERS, 1924-1928

GENERAL TYPE OF OCCUPANCY	Number of Fires	Total Loss	Per Cent. of Loss
I. Mercantile (mostly tenant)	181	\$433,691	16.5
II. Warehouses	31	225,450	8.6
III. Manufacturing (single tenant)	91	218,386	8.4
IV. Tenant Manufacturing	387	1,539,422	58.7
V. Miscellaneous	260	196,978	7.5
VI. Exposures	2	7,218	0.3
	952	\$2,621,145	100.0

Nearly 60 per cent. of the sprinklered losses are in sprinklered tenant manufacturing properties.

CONSTRUCTION OF THE BUILDING

Data regarding the extent to which building construction was a factor, was very incomplete on most of the fire reports. For instance, the construction of the building in which a fire occurred would be designated simply "brick" or "frame." No data would be given as to whether the "brick" building was brick and light wood-joist, or heavy timber "mill" construction, or fire resistive, so that in the "brick" class were those of widely differing fire resistance.

Data as to how the fire spread through the building was generally lacking, although a considerable number of the reports, indicated briefly that the fires spread "through open spaces" meaning, presumably, vertical openings such as stair and elevator shafts, dumb-waiter shafts and hollow spaces in unfirestopped partitions.

The construction of the buildings in which occurred the 283 fires with losses over \$15,000 for 1923-1927 was, however, carefully determined. Practically all of these buildings had ordinary brick walls with light wood interior construction and without sprinkler protection. Strange as it may seem, scarcely any more detailed data regarding the factors responsible for the start and spread of these large fires was given on the reports than in the case of the general run of inconsequential fires. This incomplete data on construction was supplemented, however, by information obtained through conferences with some of the fire officers who had served at the fires in question. Their recollection, plus the data available, brought out the important fact that in most cases the spread of fire and the large loss was due to *unprotected vertical openings* through which fire could spread unhindered to involve the whole building. In tenant buildings, which had the worst record of large fires, this was found to be particularly true.

In fact it can be said that, once a fire is started, the unprotected vertical opening is the one predominating factor causing the large loss fires in the city.

Where the fires were in buildings protected by automatic sprinklers the construction factor was secondary, because the sprinkler protection, even in wood interior buildings of poor general construction, tended to offset the structural hazard. Practically the only serious fires in the five years in sprinklered property were in the two cases where the sprinklers were shut off.

Building and Fire Department inspectors should be on the lookout for structural defects, ordering their correction as far as possible under the law.

AUTOMATIC SPRINKLER PROTECTION

The Significance of Sprinkler Protection. It may appear to the lay reader that automatic sprinklers as protection against fire are being unduly stressed. Sprinklers, however, occupy the position of the most dependable and effective fire protection device known. They were developed originally in the textile mills of New England. Their application to the protection of these mills changed them

from one of the worst classes of industrial fire hazard to one of the safest. Sprinklers have since been applied to the protection of almost every known fire hazard or type of building with exceptionally satisfactory results.¹

The number of fires in sprinklered property is a relatively small proportion of the total number of fires. (There were 952 sprinkler fires in the five years 1924-1928.) These fires have a special importance, however, because the burnable values involved are tremendous. It is estimated that the property in Boston protected by automatic sprinklers amounts to over a billion dollars of burnable value which makes sprinkler fires of relatively greater importance than the general run of fires studied in this record. (For a further discussion of the significance of sprinkler protection see Chapter 10.)

Boston's Sprinklered Fire Record. The following summary analyzes the fires in sprinklered properties by amount of loss:

FIRES IN SPRINKLERED PROPERTIES, 1924-1928

SIZE OF FIRE	Number of Fires	Loss	Per Cent. of Loss
"No Loss" Fire	362	—	—
Under \$4,500 Loss.....	424	\$430,876	16.5
Over \$4,500 Loss.....	166	2,190,269	83.5
Totals.....	952	\$2,621,145	100.0

A special study of the few fires causing over 80 per cent. of the losses was made, to see what factors caused these to be larger than the ordinary run of sprinklered fires. As most of the large losses were due to occupancy conditions these fires are discussed in detail under the next heading.

The following table showed that in general the losses on contents of a building is over four times greater in sprinklered fires than the loss to the building itself. This is to be expected as most of the fires are promptly extinguished by the sprinklers before reaching such proportions as to involve the structure of the building.

FIRES IN SPRINKLERED PROPERTIES, 1924-1928

Losses on buildings	\$462,763
Losses on contents	2,158,382
Total	\$2,621,145

¹ The fire record department of the National Fire Protection Association has on file detailed reports on over 40,000 fires in properties protected by automatic sprinklers, covering sprinkler systems good, bad and indifferent, and all kinds of occupancies and hazards, and for a period of over 30 years. In this record the average efficiency of sprinklers is shown to be 96 per cent.



Photo by Blackinton.

Looking up the stairway of an apartment house in which a fire has occurred. Fire readily spreads up through such unenclosed stairways as well as up through the spaces in the walls between the studs. These spaces are clearly shown in the picture. Such stairways should be enclosed and frame partitions should be properly "fire stopped."

A summary of the figures reported by the Boston Protective Department on sprinkler operation shows the following:

That 55 per cent. of fires are extinguished with only one sprinkler operating and that not over two heads operated in 75 per cent. of the fires (Appendix 4 A).

That 36 per cent. of all fires in sprinklered properties start in the basements. This is probably true of unsprinklered properties as well. (Appendix 4 B.)

Out of 1,456 sprinklered fires attended in the 10 years, 1918–1927, in 1,228 cases, or 84.3 per cent., the Protective Department put the system in operating condition before leaving the premises.

Losses due to sprinkler leakage are trivial in view of the huge values involved, having averaged only \$28,000 a year in the ten years 1918–1927, on an average of 42 such losses a year. (Appendix 3 C.)

General Observations on Sprinkler Protection. From the reports of sprinklered fires it is evident that the water supplies in Boston are generally adequate to feed the number of sprinklers which may open. Proper attention has generally been paid to the location of sprinklers and to problem of distribution of water, so that in the majority of cases only a few heads opened. It is evident, however, that property owners must be made to realize that attention must be given to these details if water losses are to be kept at a minimum and the full advantages of sprinkler protection obtained. An obvious need for supervisory fire alarm service was noted in many of the fires where the losses were above average, as delayed alarms were frequently a factor in these fires.

SPECIFIC OCCUPANCIES

The most significant study of fire losses is by the specific occupancy involved. Fire hazards vary more due to occupancy or combinations of occupancies than because of any one other factor.

The 1927 Fire Record. Losses in residential buildings have already been studied according to their general type. In Table 83 are given the number of fires and losses in buildings other than residential, according to the occupancy in which the fire originated. This study cannot show any relation of losses experienced to burnable values in any given occupancy. Table 83, therefore, merely shows that fires in non-residential buildings in 1927 resulted in over \$2,000,000 loss and indicates the occupancies in which the losses predominated.

Provision stores, restaurants, and miscellaneous retail stores show high frequency and large losses. The shoe and leather industry shows few fires but large losses which are due to the damageability of the stock involved.

TABLE 83
FIRES IN NON-RESIDENTIAL BUILDINGS, 1927
(Losses Over \$500 per Fire)
NUMBER OF FIRES AND LOSSES BY TYPE OF OCCUPANCY

OCCUPANCY	Total Loss	Number of Fires	Per Cent. of Total Fire Loss
1. Retail Stores (Exclusive of Items 4-10).....	\$258,149	54	10.9
2. Shoe and Leather (Manufacturing and Wholesale).....	152,185	8	6.5
3. Restaurants.....	140,653	25	5.9
4. Provisions and Groceries (Retail).....	137,154	45	5.8
5. Furniture.....	107,667	19	4.6
6. Dry Goods.....	72,080	8	3.1
7. Men's Clothing.....	55,900	11	2.4
8. Women's Clothing.....	43,953	11	1.9
9. General Clothing.....	40,232	9	1.7
10. Shoe Retail.....	23,694	7	1.0
11. Large Fires in Individual Known Occupancies other than above,	836,082	19	35.4
12. Small Fires in Miscellaneous Known Occupancies other than the above.....	489,049	159	20.8
Total.....	\$2,356,798	375	100.0

Table 83 further illustrates the effect of single large fires on the record of any class of occupancy and shows that more than a single year's fire record is needed to fairly measure the fire experience of any occupancy.

The Record of Fires Over \$15,000 Loss, 1923-1927. The record of the losses in the 283 large fires which account for 56 per cent. of the total loss in the five years 1923-1927 is for a long enough term to provide a dependable supplement to the record of the single year 1927. The losses by occupancies are given in Table 84, classified by five general types.

In the Mercantile group, Retail Stores show the greatest number of large fires, but the largest losses are in the Tenant Mercantile occupancies. The large loss attributed to Wholesale Clothing was due to one exceptionally large fire, so the figure is inconclusive.

In the Tenant Manufacturing class, the clothing industry is responsible for the larger part of Boston's fire loss, Women's Clothing being the chief offender.¹

¹ See, also, the record of sprinklered clothing factories, Table 87.

TABLE 84
LOSSES BY OCCUPANCIES IN FIRES EXCEEDING \$15,000 PER FIRE
FIVE YEAR PERIOD, 1923-1927

NOTE.—This table includes losses in fires in both sprinklered and unsprinklered property. The losses entered against each occupancy include losses in other occupancies caused by the fires in the occupancy listed. Loss figures are those of the Boston Protective Department as entered on the Fire Department reports.

GROUP I. MERCANTILE	Number of Fires	Total Losses Due to Fires in Each Class
Tenant Mercantile.....	27	\$1,416,872
Wholesale Clothing.....	1	1,269,300
Wholesale Shoes.....	7	1,012,413
Retail Stores.....	30	995,475
Wholesale Foods.....	9	983,980
Wholesale Leather.....	7	712,712
Wholesale Peanuts.....	1	175,035
Wholesale Paper.....	4	149,331
Wholesale Toys.....	2	107,856
Wholesale Electric Jobbers.....	1	86,533
Wholesale Lumber.....	3	77,534
Wholesale, General.....	2	73,584
Wholesale Music Supplies.....	1	41,760
Wholesale Tobacco.....	1	17,366
Wholesale Furniture.....	1	16,691
Total.....	97	\$7,136,442
GROUP II. WAREHOUSES		
Paper.....	2	\$256,902
Wool.....	3	161,224
Artificial Silk.....	2	89,099
Caskets.....	1	53,376
Food.....	2	47,634
Wharf.....	1	37,940
Pottery.....	1	25,452
Total.....	12	\$671,627
GROUP III. MANUFACTURING (SINGLE TENANT)		
Ship Yards.....	1	\$342,758
Metal Work.....	5	272,969
Foods.....	4	158,158
Brewery Bottling.....	3	122,639
Drugs.....	1	108,401
Cigars.....	1	103,710
Dyes, Paints.....	2	79,092
Clothing (General).....	2	57,142
Wood Working.....	1	35,183
Furniture.....	1	16,233
Miscellaneous.....	3	58,464
Total.....	24	\$1,354,749

TABLE 84, *Continued.*

			Number of Fires	Total Losses Due to Fires in Each Class
GROUP IV. TENANT MANUFACTURING				
Clothing:	Number of Fires	Loss		
Women's.....	24	\$663,170		
Men's.....	5	152,900		
General.....	7	208,616		
			36	\$1,024,686
Foods.....			7	302,759
Metal Trades.....			5	206,789
Towels.....			1	152,254
Wood Working.....			5	123,906
Bottling Work.....			3	116,576
Mattress and Upholstering.....			3	112,412
Leather (Shoes and Bags).....			4	83,471
Cork.....			1	70,777
Furniture.....			2	62,242
Novelties.....			3	51,761
Cigarettes.....			1	46,481
Dyes.....			1	35,979
Miscellaneous.....			6	135,411
Total.....			78	\$2,525,504
GROUP V. MISCELLANEOUS				
Dwellings other than apartments.....			13	\$523,093
Apartments.....			13	432,648
Offices.....			8	298,184
Restaurants.....			7	215,707
Schools.....			4	174,630
Stables.....			6	154,848
Churches.....			3	131,171
Lodges and Clubs.....			4	115,735
Printing Establishments.....			4	106,052
Railroad Property.....			2	84,770
Wharf Property.....			2	62,186
Hotels.....			2	36,934
Hospitals.....			1	28,461
Not Classified.....			3	92,303
Total.....			72	\$2,456,722
Grand Total.....			283	\$14,145,044

The Record of Fires in Properties Equipped With Automatic Sprinklers, 1924-1928. Total losses in all fires in sprinklered property by occupancies are given in Table 87. In studying the losses in these fires it should be remembered that the values involved in the fires are very high, much higher than in most unsprinklered occupancies. Unfortunately no figures on these values are available so that direct comparison of the relative losses in the sprinklered units of a specific occupancy with the unsprinklered ones is not possible.¹ The number of fires and losses is, however, of considerable interest.

¹ Because of this, and because Table 84 gives only the losses in the big fires, no direct comparison of the losses by occupancies in Tables 84 and 87 should be made.

The most significant fact is that in the 952 sprinklered fires there are practically no losses of the size of those listed in Table 84, which all exceed \$15,000. The largest fires in the sprinklered record average only about \$13,000. Because we know values protected by sprinklers are large, the low losses, even in hazardous manufacturing properties, show that the results from sprinkler protection are highly satisfactory. In most classes it is apparent that the ratio of the losses to the value of the properties is very low, which should be of great interest to owners of properties equipped with automatic sprinklers.¹

In Table 87 the Retail and Wholesale Stores, especially department stores, show very low losses in spite of high values. There are a few large losses in warehouses where property values are also very large. Manufacturing occupancies, other than Tenant Manufacturing, show an excellent record. (Sprinklered manufacturing occupancies also have an excellent record throughout the country.)

The Tenant Manufacturing losses are high. Study of the fire reports showed this was due to the general character of the occupancy, and the old wood-interior buildings in which it is housed. The losses are much too high when compared to the very low losses in other sprinklered industrial properties.

The effectiveness of sprinkler protection in garages and theaters is noteworthy. There were no large losses in these classes. Sprinklers also show up well in printing establishments considering the damageability of stock and machinery.

Factors Causing Large Losses. As has been stated, the fire reports on the large loss fires in unsprinklered occupancies seldom gave any record of the factors causing the large losses. The reports of fires in sprinklered property, however, furnished very satisfactory data as to factors contributing to large losses. All sprinklered fires where the loss was over \$4,500 (a relatively large figure for the loss in a fire where sprinklers are involved) were studied in detail.

Even the larger losses in mercantile occupancies were relatively small fires, as in only one case did over six sprinkler heads open. (In that case a "flash" fire occurred in a stock of office furniture wrapped in excelsior.) But with the large values involved, any fire would cause serious loss.

Heavy water losses occurred in several fires in the warehouse class. Two were in stocks of easily damaged artificial silk and two were in wool waste. These four fires alone caused about \$160,000 loss. In one case a large loss in a casket warehouse occurred when the sprinkler system was prematurely shut off. (There were two fires occurring almost simultaneously. The system was turned off before the second was discovered.)

¹ Reasons for this good record are excellent water supplies, the high average quality and condition of sprinkler systems and good maintenance. The good condition and maintenance of sprinkler systems is largely due to close supervision by the Boston Board of Fire Underwriters, the service rendered by the Boston Protective Department and insurance interests generally.

TABLE 87
FIRE LOSSES IN PROPERTIES EQUIPPED WITH AUTOMATIC SPRINKLERS
FIVE YEAR PERIOD, 1924-1928

OCCUPANCY CLASSIFICATION	Number of Fires	Total Loss	Per Cent. of Loss
I. Mercantile:			
Retail Stores.....	51	\$94,475	3.6
Tenant Mercantile.....	64	126,459	4.8
Department Stores.....	23	23,421	0.9
Wholesale Leather.....	8	18,199	0.7
Wholesale Shoes.....	11	37,814	1.4
Wholesale Dry Goods.....	10	85,283	3.3
Wholesale Groceries.....	5	43,157	1.7
Wholesale Miscellaneous.....	9	4,883	0.2
Total.....	181	\$433,691	16.6
II. Warehouses:			
Artificial Silk.....	2	88,904	3.4
Furniture.....	4	6,116	0.2
Paper.....	7	14,444	0.6
Wool or Wool Waste.....	3	72,631	2.8
Miscellaneous.....	15	43,355	1.6
Total.....	31	\$225,450	8.6
III. Manufacturing:			
Metal Work.....	11	29,016	1.1
Shoes.....	6	61,375	2.3
Woodworking.....	7	34,438	1.3
Tobacco.....	1	5,806	0.2
Candy.....	7	16,216	0.6
Miscellaneous.....	59	71,535	2.8
Total.....	91	\$218,386	8.3
IV. Tenant Manufacturing:			
Clothing (Dresses, Caps, etc.).....	106	764,895	29.2
Mattress, Upholstering and Pillows.....	66	143,436	5.5
Metal Work.....	19	80,404	3.1
Leather Goods (Novelties).....	15	79,547	3.0
Shoes and Slippers.....	33	61,243	2.3
Furniture.....	18	19,098	0.7
Miscellaneous.....	130	390,799	14.9
Total.....	387	\$1,539,422	58.7
V. Miscellaneous:			
Apartments.....	68	42,220	1.6
Hotels.....	8	11,636	0.4
Hospitals.....	4	1,172	0.0
Theaters.....	10	25,471	1.0
Restaurants.....	29	24,681	0.9
Drugs and Chemicals.....	1	5,052	0.2
Printing.....	36	65,039	2.5
Garages.....	67	7,117	0.3
Laundries.....	15	9,711	0.4
General Miscellaneous.....	22	4,879	0.2
Total.....	260	\$196,978	7.5
V. Exposures:			
Total.....	2	7,218	0.3
Grand Total.....	952	\$2,621,145	100.0

In manufacturing (other than tenant) sprinklers operated successfully, putting out the fire or holding it in check in all cases. A large number of sprinklers opened in one fire in an oiled clothing factory and also in a plant where sheet pyroxylin (celluloid) was used, as is to be expected in such extra-hazardous properties.



Photo by Blackinton

A tenant manufacturing building in the South End occupied principally by woodworking plants. The fire shown started in a dry kiln and was subdued by the fire department after a stiff battle.

The majority of large loss fires in sprinklered tenant manufacturing started in the occupancies of clothing, dress manufacturing and allied trades. The clothing class accounted for about 25 per cent. of the entire loss in all sprinklered properties. The fires were usually caused by smoking or are of unknown origin, frequently of a suspicious nature. The majority of the fires occurred at night and in many cases the fire alarm was given by the police or some outsider who heard the sprinkler gong ringing. The result was considerable delay before the fire and protective departments arrived and the water was shut off, causing excessive water damage.

Two large losses occurred in this occupancy because the sprinklers were shut off. (These are the only cases of a sprinkler system being shut off at the time of a fire in the five-year record which shows that generally satisfactory maintenance is being provided for sprinkler systems.) These two cases especially demonstrate the need of central station supervisory service for all sprinkler systems, not only to prevent water damage but so that an alarm may be transmitted at once to the fire department when sprinklers are out of commission.

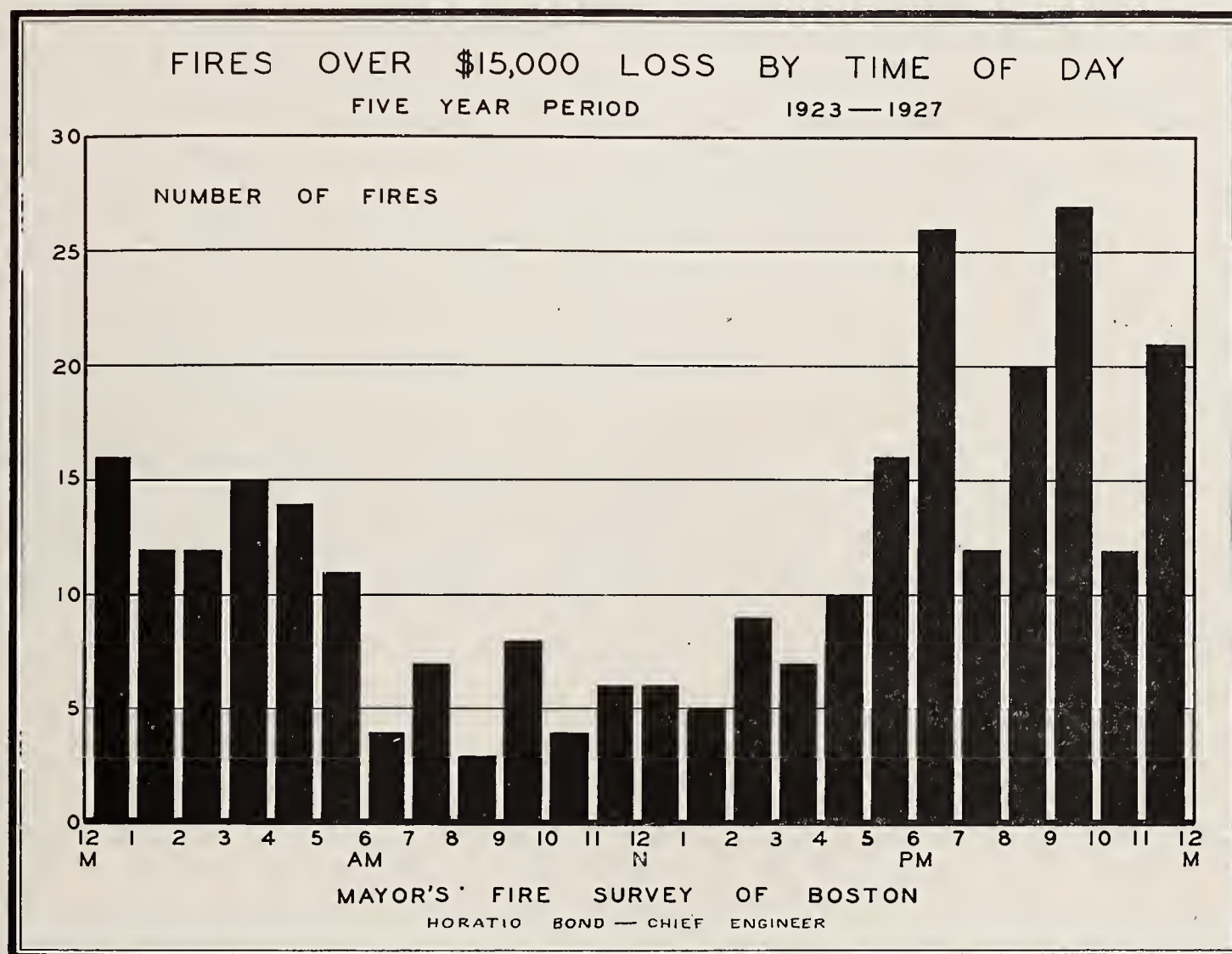


FIGURE 89.

In several cases fires spread under cutting benches and attained considerable headway before the sprinklers could control them. Draft stops, limiting the spread of fire under benches are needed.

The Shoe and Leather Industry. This industry, in its wholesale and manufacturing branches, has had relatively few fires, but very large losses, totaling \$152,000 in 1927, a good year, and in the five years, 1923–1927, losses of nearly \$2,000,000 in fires of over \$15,000 alone.

The allied shoe and leather industry is one of Boston's leading commercial groups, made up of the factories, warehouses and offices of upwards of 1,000 concerns. Much of Boston's prosperity depends upon it, and the loss of individual plants by fire may result in relocations in other parts of the country. The local shoe and leather industry should undertake a study of its properties to see what can be done as an industry to correct its bad loss record.

Retail Stores. Except large department stores, retail stores generally have a poor fire record. Of these provision stores (groceries, etc.) and restaurants have the poorest record, the result of a large number of fires with moderate individual losses. Stores in combination with dwellings also showed a bad record.

Incombustible partitions at least should be required in all stores, old and new, and automatic sprinklers in basements where the areas are at all sizeable. All retail stores should be frequently inspected by the fire department.

Tenant Buildings. Multiple tenant buildings (mercantile or manufacturing) contributed over half of the losses in non-residential buildings in 1927. The tenant class has poor housekeeping conditions causing frequent fires, and the grouping of different kinds of stock causes inevitably heavy losses due to smoke and water. Attention to housekeeping is vital in this occupancy. Sprinklers, even in this bad class, have a good record compared to the record of unsprinklered tenant mercantile buildings.

EXPOSURE

Record of Fires with Losses over \$15,000, 1923=1927. A study of the losses suffered by the various occupancies listed in Table 84 from fires starting in other occupancies was made. Wholesale leather, for example, suffered about \$11,000 loss from fires starting in other occupancies. Wholesale shoes had losses of this kind amounting to about \$40,000. In addition to the \$153,000 loss due to fires starting in men's clothing tenant manufacturing occupancies there were additional losses to these occupancies of some \$150,000 due to fires which started in other occupancies.

A conclusion which can be drawn from this study is that industries which have high-valued and easily damageable stocks should select for occupancy buildings where the other tenants are not likely to have fires. For example, it would be obviously poor judgment for a leather concern to have storage space in a tenant manufacturing building.

Record of Sprinklered Fires, 1924=1928. The factor of exposure is present even with sprinkler protection. Study of individual fires in sprinklered



Photo by Blackinton.

A fire in a combination store and dwelling building of the "three decker" type. This is a common type of fire.

properties shows that losses are frequently unnecessarily large because stock of a nature easily damaged by water was stored in large quantities in buildings subject to numerous small fires.

The careful analysis of sprinklered fires with losses over \$4,500 showed one case where a sprinklered garage was damaged about \$6,500 by a severe fire in an adjacent unsprinklered building. That there should be only one such case is somewhat remarkable, for while sprinklers may be depended on to prevent an exposure fire getting a foothold in the building so equipped, when they are not supplemented by window protection, some damage to the building or contents may result.

TIME OF DAY WHEN FIRE OCCURRED

Fires with Losses over \$15,000, 1923-1927. Fig. 89 shows the number of large fires by hours of the day. The time of day when serious fires occur is more important than that of the ordinary run of fire alarms, so only the serious fires

were included in this study. It will be seen that the critical time of day is between 5 p. m. and 6 a. m., with peaks between 6 and 7 p. m. and 9 and 10 p. m. It was at these peak hours also that losses were found to be heaviest as well.

CAUSES OF FIRES IN BUILDINGS

On every report of a fire, the chief of the district in which the fire occurred puts down his best guess as to the cause. It is not the practice for that officer to make any detailed investigation of the fire.

A summary of the causes assigned to fires in buildings in 1927 is given in Appendices 4 C and 4 D. This sheds very little information as to the origin of the fires in most cases. Causes such as "spontaneous ignition," "smoking," "matches," "incendiary," are unconvincing. These, together with those admittedly unknown, total practically one half of all the causes assigned.

In the case of the large fires, the proportion of unknown causes is even greater, showing that no more is known about the serious fires than about the ordinary ones. Of the 26 large fires in residential occupancies with losses exceeding \$15,000, 15 were reported as of unknown origin. (Appendix 4 E.) In non-residential buildings the situation was much worse. Of 257 such fires (fires which accounted for over one half of all the fire losses 1923-1927) 208, or 80 per cent., were reported of unknown origin.

While it is obviously difficult to always assign a correct cause of a fire, the apparent guessing at causes, together with the general lack of other essential data reported on the fire, shows that with the exception of the very few sprinklered fires, the investigation of fires is decidedly superficial.

PART OF CITY IN WHICH FIRE OCCURRED

Fire prevention effort, to be effective, must be directed where it will do the most good. A compilation of data to show the part of the city where the fires have been most frequent and losses heaviest was therefore made.

Where Losses Have Been Heaviest. The Fire Department has made a practice since 1926 of compiling losses by the various fire department districts to roughly measure the effectiveness of the attack on fires in each district. These figures for four years are given in the following table.

As might be expected, because of the concentration of values, the downtown districts have the heaviest losses. Most significant, however, is the fact that losses have been reduced in the high value section of the city included in Division 1 of the Fire Department. Of the districts in this division the losses in 1927 and 1928 were reduced from the 1925 and 1926 levels in District 1, East

Boston, District 2, Charlestown, District 4, Northern Downtown District and West End, and District 5, Retail District. The Wholesale District (District 3) showed no material improvement.

The losses in Division 2 have increased, while a very slight decrease occurred in the outlying districts included in Division 3.

Spot Maps. With the idea in mind of defining those areas of the city with considerable fire hazard, a series of spot maps of fires in buildings have been made. These spot maps show that certain sections of the city have more fires and greater losses than others. Consequently, they serve the very useful purpose of defining districts where inspections by the Fire Department must be made more frequent and intensive. (See Chapter 12.)

FIRE LOSSES BY FIRE DISTRICTS

DISTRICT	LOCATION (For Fire Districts, see Fig. 94.)	LOSS (THOUSANDS OF DOLLARS)			
		1925	1926	1927	1928
1.....	East Boston.....	389	489	82	160
2.....	Charlestown.....	340	77	56	39
3.....	Downtown Wholesale District.....	235	588	379	543
4.....	Downtown and West End.....	1,394	1,267	643	504
5.....	Retail District.....	1,025	657	376	434
6.....	South Boston.....	85	114	98	221
7.....	South End and Back Bay.....	341	491	499	690
8.....	Fenway.....	537	413	360	307
9.....	Roxbury.....	201	204	167	139
10.....	Dorchester (North).....	159	142	171	189
11.....	Brighton.....	137	173	295	150
12.....	Jamaica Plain.....	168	201	273	120
13.....	West Roxbury.....	115	105	106	49
14.....	Dorchester (South).....	162	149	150	288
15.....	Hyde Park.....	116	128	40	53
	Totals.....	5,404	5,198	3,695	3,886

RECAPITULATION

Division 1 (Districts 1-5, inclusive).....	3,383	3,078	1,536	1,680
Division 2 (Districts 6, 7, 8 and 11).....	1,100	1,191	1,252	1,368
Division 3 (Districts 9, 10, 12, 13, 14, and 15).....	921	929	907	838
Totals.....	5,404	5,198	3,695	3,886

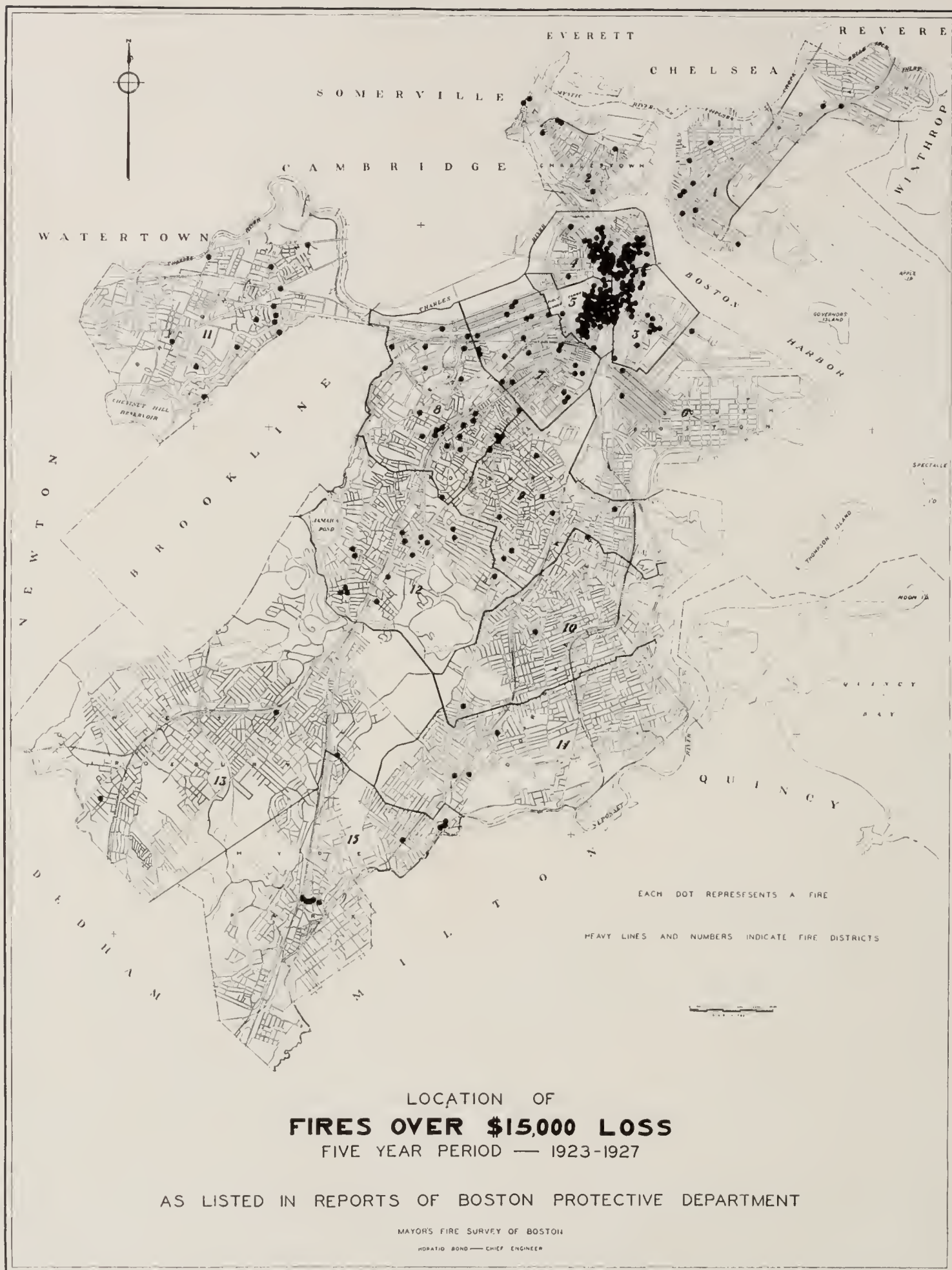


FIGURE 94.

(94)

A preliminary spot map was made locating the fires with losses exceeding \$15,000 per fire which occurred during the 5-year period 1923–1927, inclusive. (Fig. 94.) This showed that the greatest number of large fires occurred in the congested district (Fire Districts 3, 4 and 5), confirming the analysis of losses by fire districts. Accordingly when the fires of 1927 were plotted, the fires in this district were plotted on a larger scale map that their location might be more accurately determined. (Fig. 99.)

In plotting the other 1927 fires, two maps were made. (Figs. 96 and 97.) On one the fires where there was a substantial loss (\$500 or over) were shown, and on the other were put the much larger number of small-loss fires. In this way, the first map would show areas where losses were occurring, and the second would indicate areas of high frequency of trivial fires.

Fires of 1927 with Loss Over \$500, Residential. (Fig. 96.) There is a distinct grouping of these fires in the general vicinity of Blue Hill Avenue and Morton Street in Dorchester, a “three decker” frame district, where the danger of a sweeping fire is high. (Fire Districts 10 and 14.) There is another grouping which extends over a wide area, but is definitely outlined as north of Seaver Street, between Walnut Avenue and Humboldt Avenue. (Fire District 12.) This is a brick and frame apartment house section. Nearby is another district where a large number of fires are occurring, starting at the junction of Talbot Avenue and Blue Hill Avenue, and extending north along Blue Hill Avenue to Quincy Street. (Fire Districts 9 and 10.)

Besides these sections there are two other major groupings of fires, one between Harrison Avenue and Tremont Street, between Massachusetts Avenue and Broadway (Fire District 7), and the other in the West End, on either side of Cambridge Street from Myrtle Street on Beacon Hill to Leverett Street. (Fire District 4.)

Fires in 1927 with Loss Over \$500, Business Buildings. (Fig. 96.) The grouping of fires over \$500 in the business buildings do not indicate as many bad sections outside of the downtown district, as for the residential buildings. Two major groupings are in the West and South End. The former is in the vicinity of Leverett Street (Fire District 4), and the latter along the Dover Street section, between Albany Street and Tremont Street. (Fire District 7.)

Other fires in this class are scattered throughout the city. Minor sections which show a grouping are at Brighton Avenue, between Franklin and Allston Streets, in Brighton, and at the junction of Columbus Avenue, Centre and Heath Streets, in Roxbury.

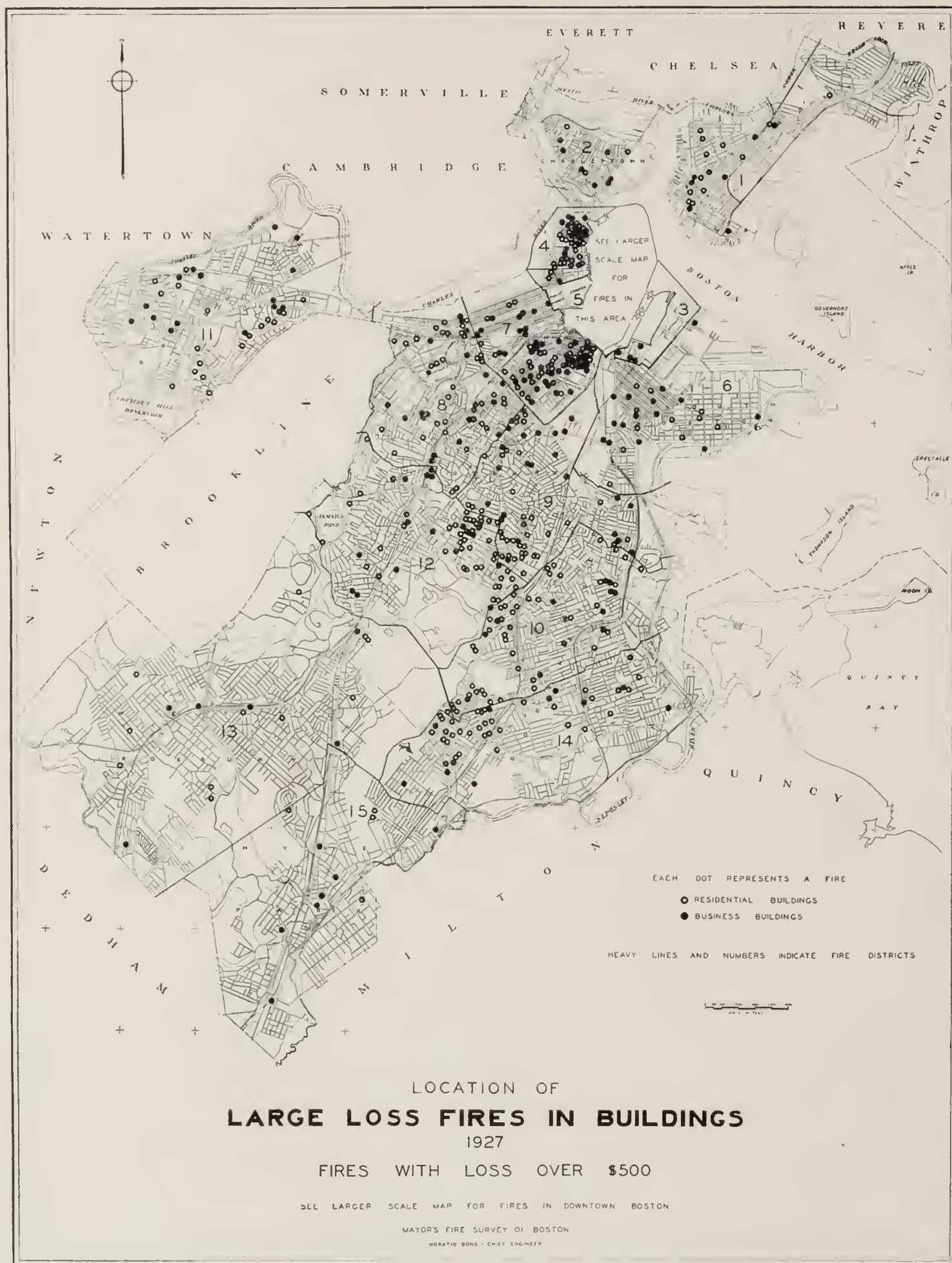


FIGURE 96.

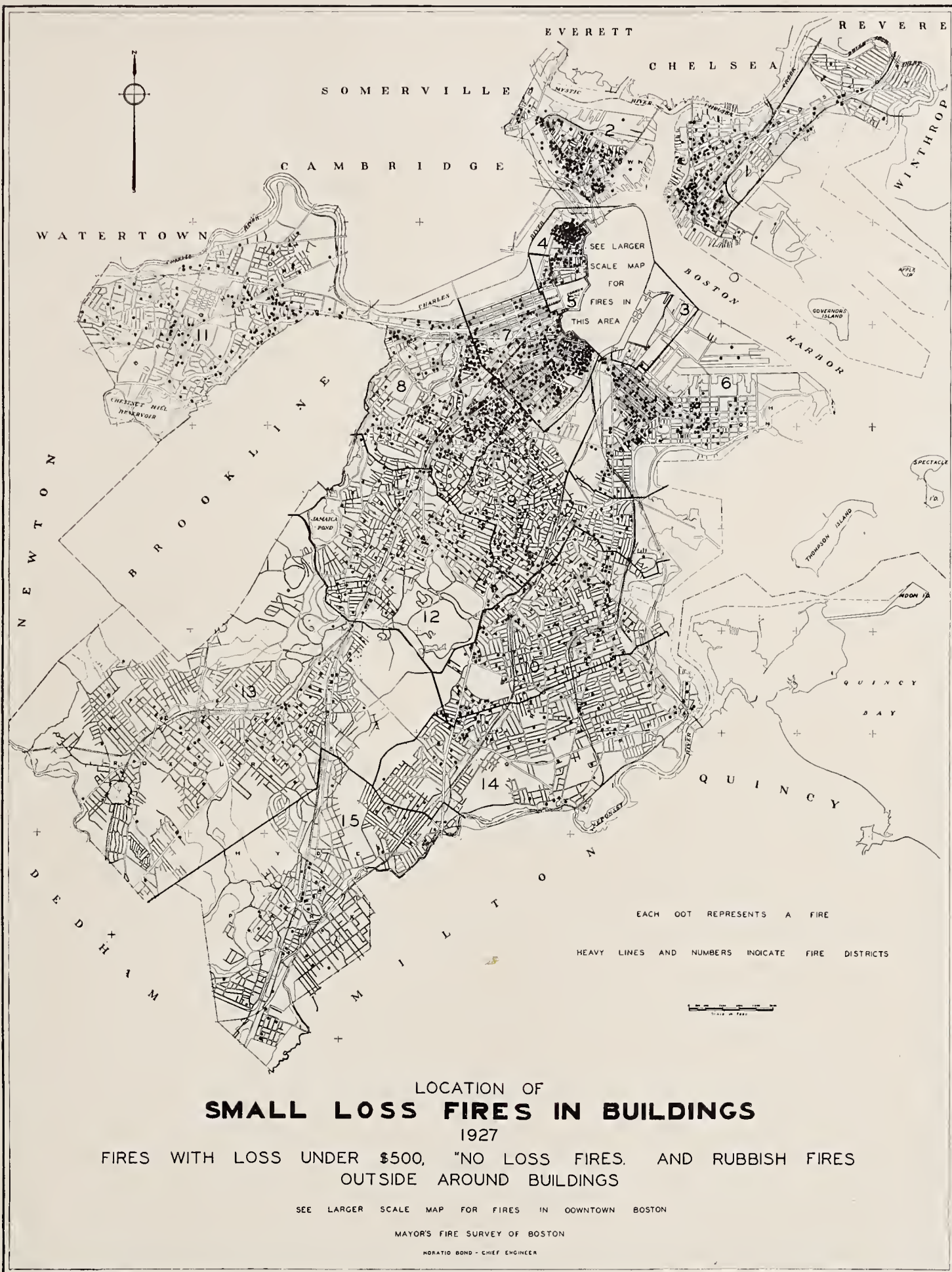


FIGURE 97.

(97)

Fires in 1927 with Small Loss, Under \$500. (Fig. 97.) Two sections of the city outside of the congested district predominate as regards fire frequency. One is in the West End, either side of Allen Street to Nashua Street, between Charles and Causeway Streets. (Fire District 4.) The other is from Randolph Street north to the railroad, between Albany Street and Washington Street. (Fire District 7.)

Other sections showing frequency of fires can be visualized from Fig. 97. A list of these general locations is given in Appendix 4 F.

Fires in the Congested District of Downtown Boston, 1927. (Fig. 99.) (Fire Districts 3, 4 and 5.) There are very few sections of this downtown district which do not show fire frequency or large fires. Fig. 99 shows only one year's fires, but by plotting all fires in this district with loss over \$15,000 for ten years (1918-1927), the blocks which have had large fires could be fairly well defined. This latter plot was used to determine downtown inspection districts and is shown in Fig. 211, Chapter 12.

The three major sections of the congested district where fires predominate are the following:

1. From State Street, north along Exchange and Union Streets to Haymarket Square, up Merrimac Street to Causeway, along Staniford Street to Cambridge Street, back through Scollay Square, to State Street.
2. The district bounded by Commercial and North Streets down to Lewis Street, from there down Fulton Street on both sides.
3. With few exceptions the blocks bounded by Atlantic Avenue, Summer, Bedford, Washington and Beach Streets.

There is also a slight concentration of big fires along Congress Street near Atlantic Avenue and on the east side of the avenue at this junction. Also a grouping on the block bounded by Summer, Federal and Winthrop Square.

CHIMNEY FIRES, 1927

Of the 3,388 fires in buildings during 1927, 338 or about 10 per cent. were chimney fires. These fires were due to the burning of soot in dirty chimneys. The fires did not spread to other parts of the building and the damage done by them was trivial, totaling only \$606 for the year. However, they caused many unnecessary runs by the Fire Department, taking away protection from certain parts of the city, and needlessly endangering the lives of citizens in the streets.

Statistics on these fires given in Appendices 4 G and 4 H show that these fires are commonest in the cold months when the chimneys are in use as might be expected. Chimney fires are most frequent in Fire Districts 7 and 8. It is also noted that there are more chimney fires in residences than in business buildings.

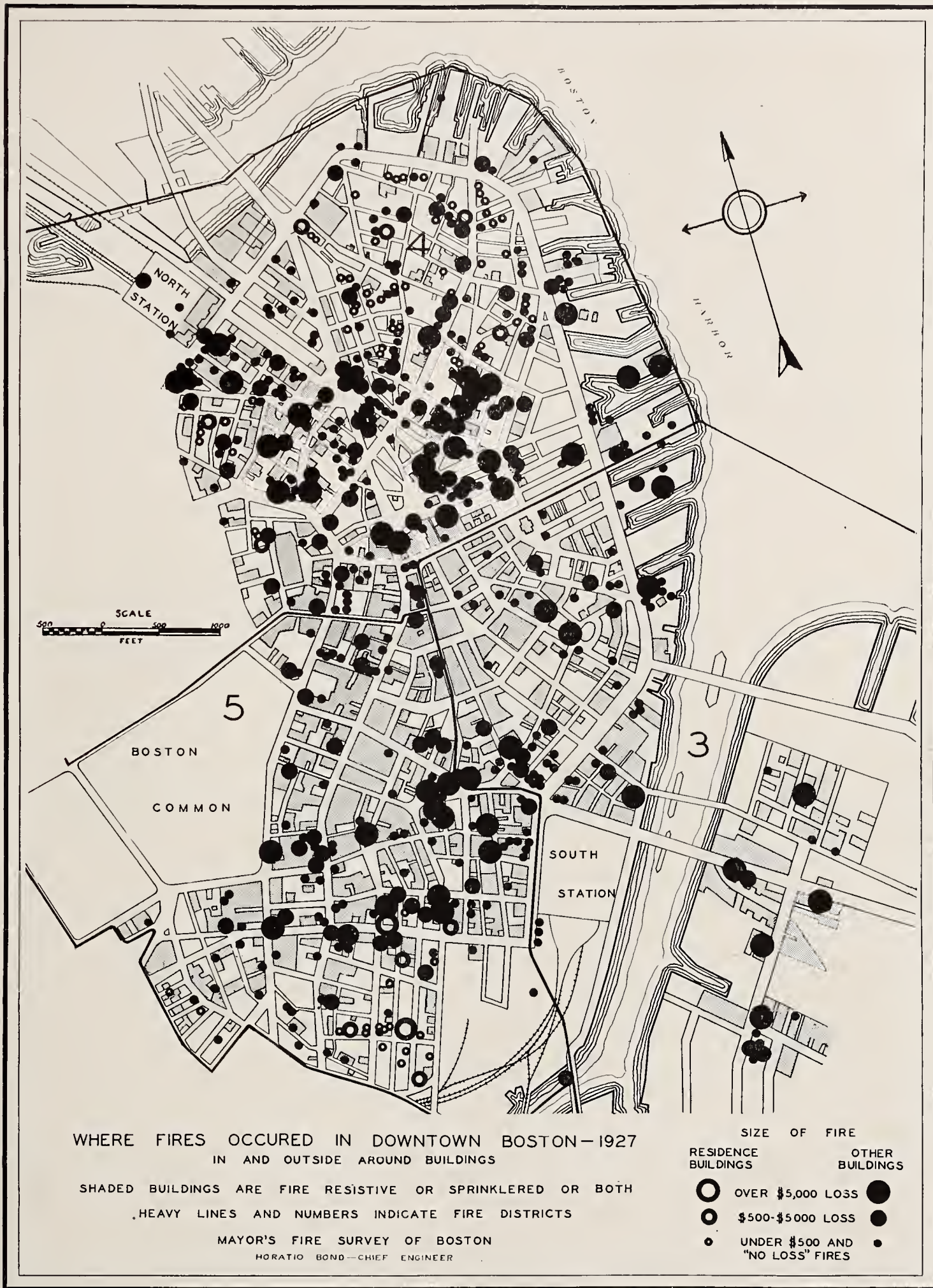


FIGURE 99.

FIRES IN RUBBISH OUTSIDE BUILDINGS

The 244 fires in rubbish outside of buildings should be studied along with building fires because the rubbish burning was, as nearly as could be determined from the fire reports, due to the building and its occupancy. Stores, for example, frequently have piles of packing material and other rubbish at their back doors. The back yards of residences are often untidy.

These fires are most frequent in dry weather, as shown by Appendix 5 A. In this respect and in causes and method of extinguishment these fires are quite similar to grass and brush fires and fires in dumps and vacant lots which are discussed in the following chapter.

Good housekeeping and frequent inspections can reduce the number of these fires.

CHAPTER 5

STUDY OF OTHER FIRES AND ALARMS

A. GRASS AND BRUSH FIRES, 1927

A study was made of the brush and grass fires in Boston during 1926 and 1927 to see if improved methods for controlling these fires could be developed. Fires in rubbish in vacant lots and dumps have been considered separately. Most fires in this classification are the burning of dead grass or small bushes and are seasonal, occurring in the spring before the new grass and foliage appear, and at dry times during open winters. (Appendix 5 A.)

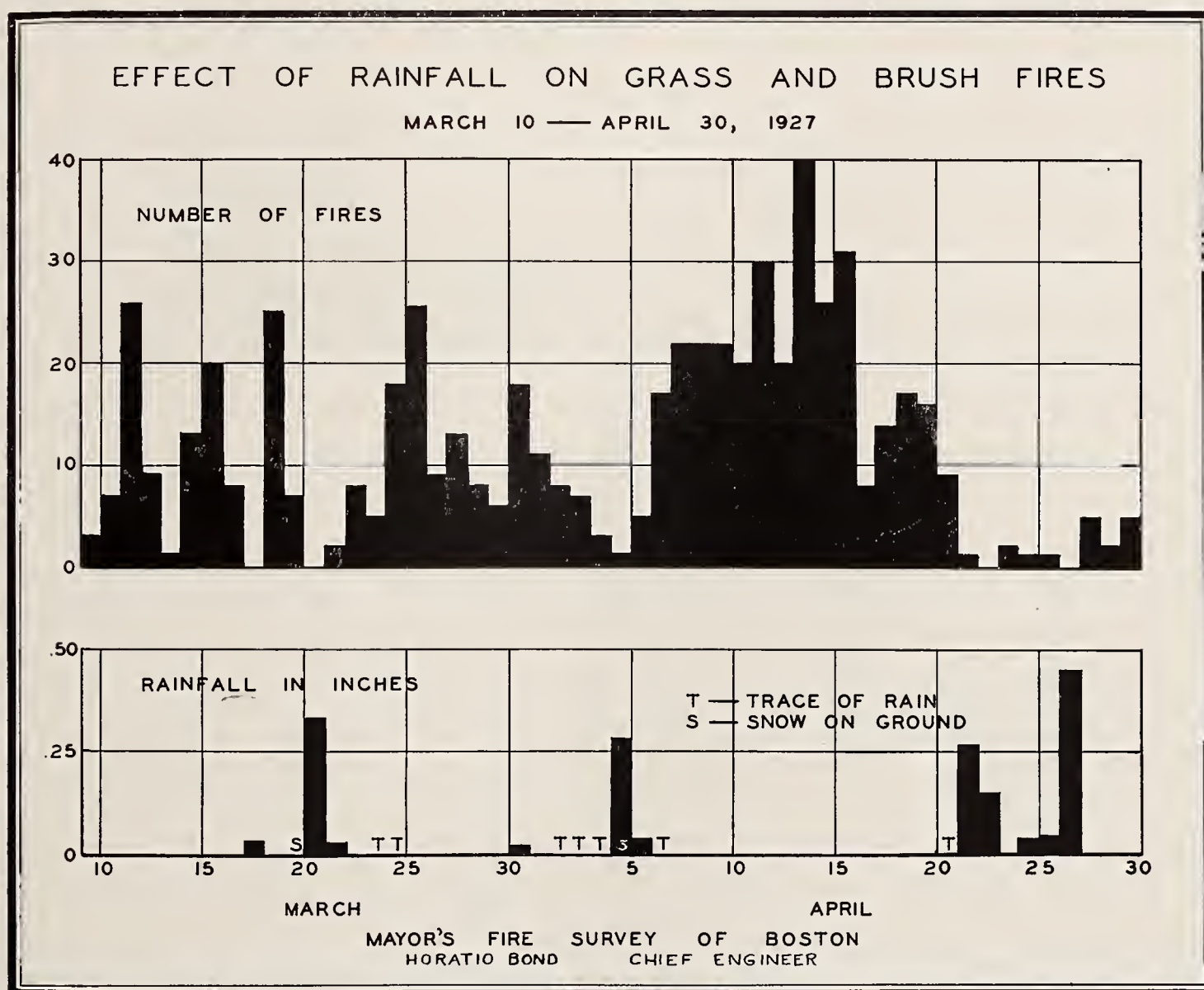


FIGURE 101.

The Rainfall Factor. To demonstrate that these fires came in dry periods, the number of fires by days, and rainfall data secured from the Weather Bureau for the same days, were tabulated and compared. The relation of brush

and grass fires to rainfall is particularly well shown by Fig. 101, a plot of the period from March 10 to April 30, 1927. Fig. 102 shows how a dry period in early winter of 1927 caused an unusual outbreak of grass and brush fires between December 17 and 29.

It is obviously easy to tell when to expect brush and grass fires by watching weather predictions. When grass and foliage is green or when there is snow on the ground these fires do not occur.

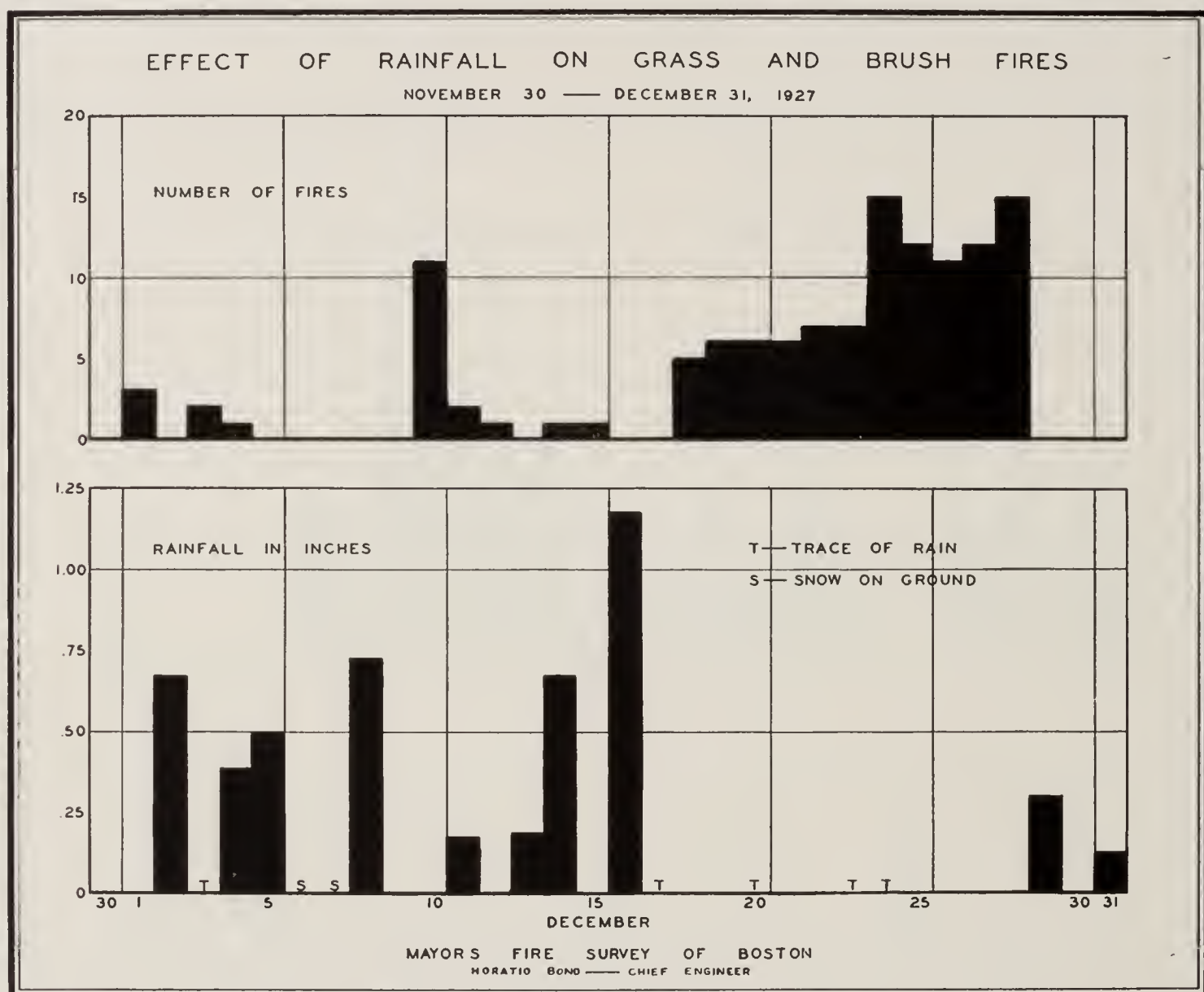


FIGURE 102.

Location. As far as possible, the locations of all brush and grass fires during 1927 were spotted on a map. In 107 out of the 864 grass and brush fires reported the location given was not sufficiently accurate to spot, but 757 fires were located. (Fig. 104.) This spot map shows a substantial number of fires in the following locations:

FIRE DISTRICT	LOCATION
1	Bennington Street, Revere end.
6	Boston Street, near Rawson Street.
11	Brighton Section, West of Market Street. (Fires are heavily scattered over this entire area.)
13	Corey Street, near Mt. Benedict Cemetery.
13	Centre Street, near Centre Terrace.
14	River Street, near Boston Sanatorium.
14	End of Morton Street, toward Pierce Square.
14	Section between Codman and Dorchester Avenue at Valley Road.
14	Franklin Field, Dorchester.
14	Hallet Street, near Neponset River.
14	Almont Street.
14	Ballou Avenue and Norfolk Street, both sides of Railroad.
15	Wood Avenue.
15	Section between Randolph and Oakland Streets on Haven and Bismarck Streets.

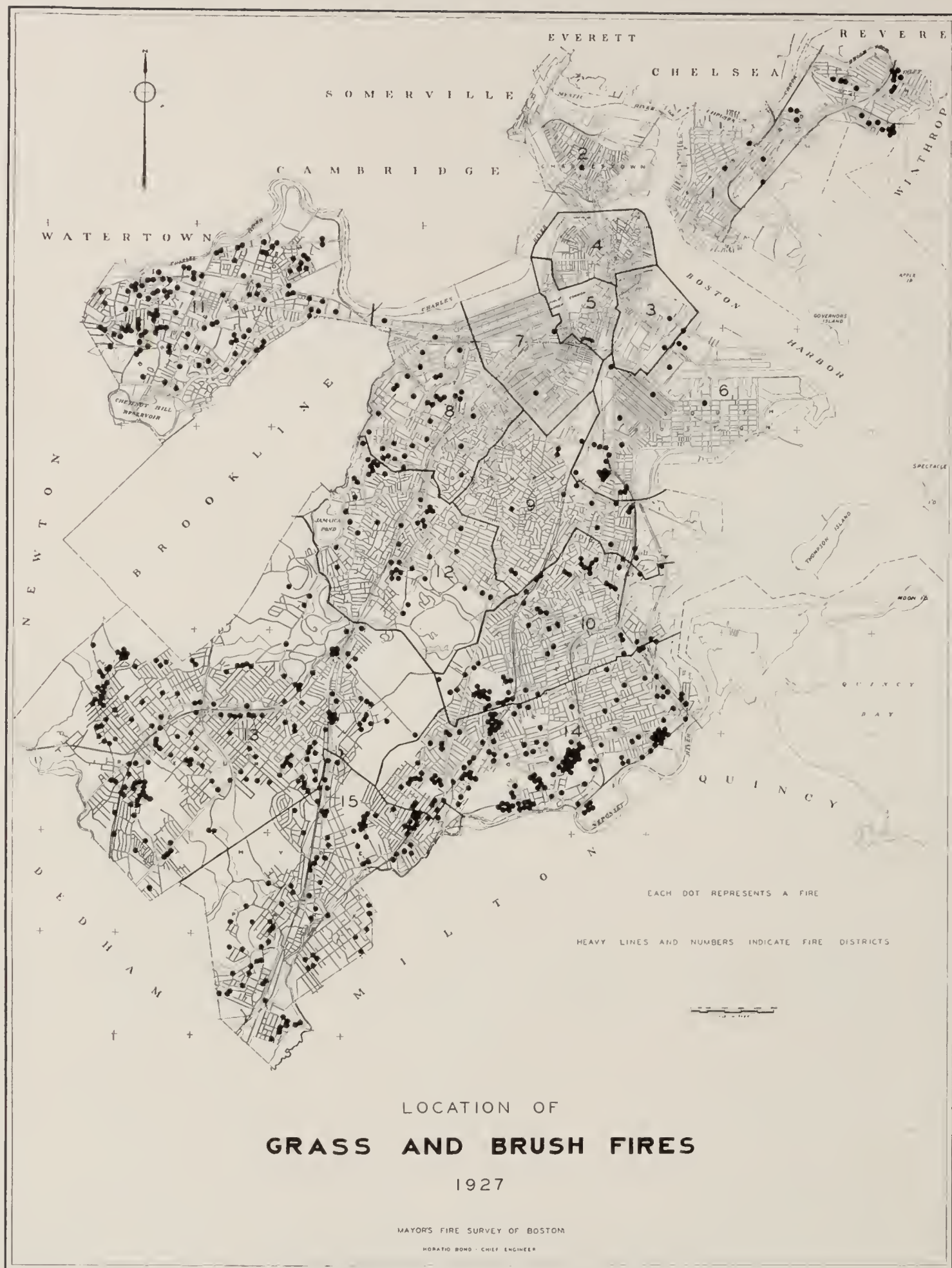
Time of Day. Grass and brush fires occur largely during the day. They start after the grass dries in the morning and stop at nightfall. They are most frequent between 12 noon and 5 p. m.

Cause of Fire. The causes assigned to brush and grass fires are largely guesswork. (Appendix 5 B.) The great majority are attributed to boys. The number of fires attributed to cigarettes or smoking seems small. Here is a type of fire which may readily be started by carelessly discarded "smokes" or matches in dry times when conditions are favorable to ignition in this manner.

Response to Fires. The response to alarms for grass and brush fires as summarized below shows that between a quarter and a third of the alarms are box alarms. This may be needlessly high.

HOW ALARM WAS GIVEN FOR GRASS AND BRUSH FIRES, 1927			
"Still" Alarms	.	.	617 71.4%
Box Alarms	.	.	247 28.6%
Total	.	.	864 100.0%

On a box alarm in residential districts, where most of these fires occur, at least three engine companies and one ladder company respond. This is obviously more apparatus than necessary for a brush fire. A still (telephone) alarm brings only one engine and one ladder truck.



How Fires Are Extinguished. The most common method of extinguishing brush and grass fires is with a wet broom. (Appendix 5 C.) In over half of these fires only brooms and watering pots or water pails were used. In only 34 per cent. of the fires were heavy streams necessary and only 4 per cent. of these were engine streams.

RECOMMENDATIONS REGARDING GRASS AND BRUSH FIRES

1. Grass and Brush Fire Patrol. The Fire Department should establish a patrol as a means of controlling brush and grass fires. The patrol idea has been successful in forest fire control where the areas to be covered are much greater than in Boston. In forest patrol work, a small light truck has been used; in city work one man, or two, if absolutely necessary, on a motorcycle equipped to handle small fires, should be adequate.

AREAS TO PATROL. While a patrol of the whole city might be impracticable, the necessary work can be greatly reduced by limiting it at first to the 14 general locations where these fires are concentrated according to the accompanying spot map (Fig. 104) or to try out patrols in a few districts.

DAYS PATROL SHOULD FUNCTION. The work of these patrols can be further lessened by watching weather conditions, on which the frequency of grass and brush fires so much depends.

TIME OF DAY PATROL SHOULD OPERATE. The patrols need not start before 9 a. m. and could safely be dismissed by 8 p. m.

EQUIPMENT OF PATROLS. A motorcycle with side car equipped with brooms, shovels, a tank of water, watering pots, pails, extinguishers and other light equipment should be tried out.

DUTY OF PATROL. The patrol is not only to extinguish fires, but to prevent the setting of fires by boys, supervise the burning over of land and otherwise see that fires do not start or spread. When necessary, assistance of the regular apparatus should be secured.

2. Educational Work. If the setting of brush and grass fires by boys is as common as the fire records indicate, education in the schools on this subject is important.

B. FIRES IN DUMPS AND VACANT LOTS, 1927

Of 615 fires which occurred in 1927, 288 were in dumps and 327 in vacant lots. These fires are also seasonable, being most frequent in the dry spring and early summer months. (Appendix 5 A.)

Location. Fire Districts 1, 8, 9 and 14 seem to have most of these fires. District 8 has a preponderance of the fires in vacant lots and District 14 the largest number of dump fires. (Appendix 5 D.)

A list of the dumps having more than 3 fires each during 1927 (Appendix 5 E) shows that 3 have had over 30 fires each and in 3 owned by one concern there were 45 fires. One dump had 52 fires. There is no justification for any organization calling on the public fire department for such continuous service as this. Owners of vacant lots should be held responsible for keeping them clean. A special clean up campaign is needed in District 8 particularly. (Appendix 5 F.)

Causes of Fires. Most of these fires are attributed to "boys," "spontaneous combustion," or "unknown." Very few of the causes seem to be definitely assigned, suggesting that they are frequently guessed at.

How Fires Are Extinguished. Most of the fires in this classification seem to have been big enough to require a 2½-inch stream for their control. (Appendix 5 G.) This indicates large amounts of rubbish burning and emphasizes the need of keeping vacant lots clean and dumps under supervision. Dump fires are an especial burden on the Fire Department because the number of injuries in fighting these fires is very high.

Recommendations. 1. Dumps which experience more than 3 or 4 fires a year should be required to provide an attendant on the premises. They also should be equipped with private hose lines which the attendant can use to control fires without summoning the Fire Department.

2. Vacant lots should be required to be kept clean.

C. OTHER FIRES AND ALARMS, 1927

Marine Fires. The Boston Fire Department has no control over the fire safety of boats and vessels. Marine fire prevention inspection is done by federal government agencies or agencies of other countries. Marine losses are not used in fire-loss comparisons of Boston with other cities. Almost all of the losses of \$232,730 in marine fires in 1927 occurred in the following large fires.

FIRE	Loss
Floating Hospital	\$200,500
Schooner	14,155
Freight Barge	11,636
	<hr/>
	\$226,291

Sixteen of the 24 marine fires in 1927 had no reported loss.

Automobile Fires. In 1927 the Boston Fire Department responded to 608 automobile fires which caused a loss of \$31,747. These are treated in some detail in Appendix 5 H.

Miscellaneous Fires Outdoors. In this class are 210 fires in all kinds of property not classifiable elsewhere. Here are included, bridges, wharves, railroad cars, poles, fences, billboards, contractor's machinery and the like. The losses in 1927 were small, totaling \$5,747, but there is likelihood of individual large fires in this class. The largest losses in 1927 were \$1,505 on a freight car and \$1,386 on an airplane.

"Accidental" Alarms. In 1927 the Fire Department responded to 146 alarms caused by accidents to, or defective, automatic sprinkler or automatic fire alarm systems.

Special Calls Where There Was No Fire. In 1927 the Fire Department made 863 runs to calls other than fires. This classification includes many for rescue work and emergencies but most of the calls are classified as "needless" by the Fire Department. The persons making the calls mistook steam, smoke, or light for a fire in most cases. (Appendix 5 I.)

Recommendations. Where a definite suggestion could be made regarding the prevention of any of these miscellaneous fires and alarms it has been made in those sections of the appendix dealing with each of the classes indicated. It is desirable to reduce these runs, mostly for trivial matters, to a minimum. The more fire calls, for whatever cause, the larger the Fire Department required.

D. FALSE ALARMS

In 1927, a normal year, there were 370 false alarms. Beginning about May 1, 1928, a startling increase in such alarms began. Taking data from May 1 to November 22 (this being data available at the time the study was started) a special study was made of the epidemic of false alarms in 1928. There were 652 during that period.

Figs. 108 and 109 show the false alarms by date, Fig. 108 for 1927, a normal year, and Fig. 109 for the epidemic of 1928. It is interesting to note how frequency of fire alarms increases around holidays.

A study of the sequence in which fire alarm boxes were pulled and the times elapsing between alarms showed quite definitely that many of the alarms were pulled systematically by a person or persons operating from an automobile and on foot.

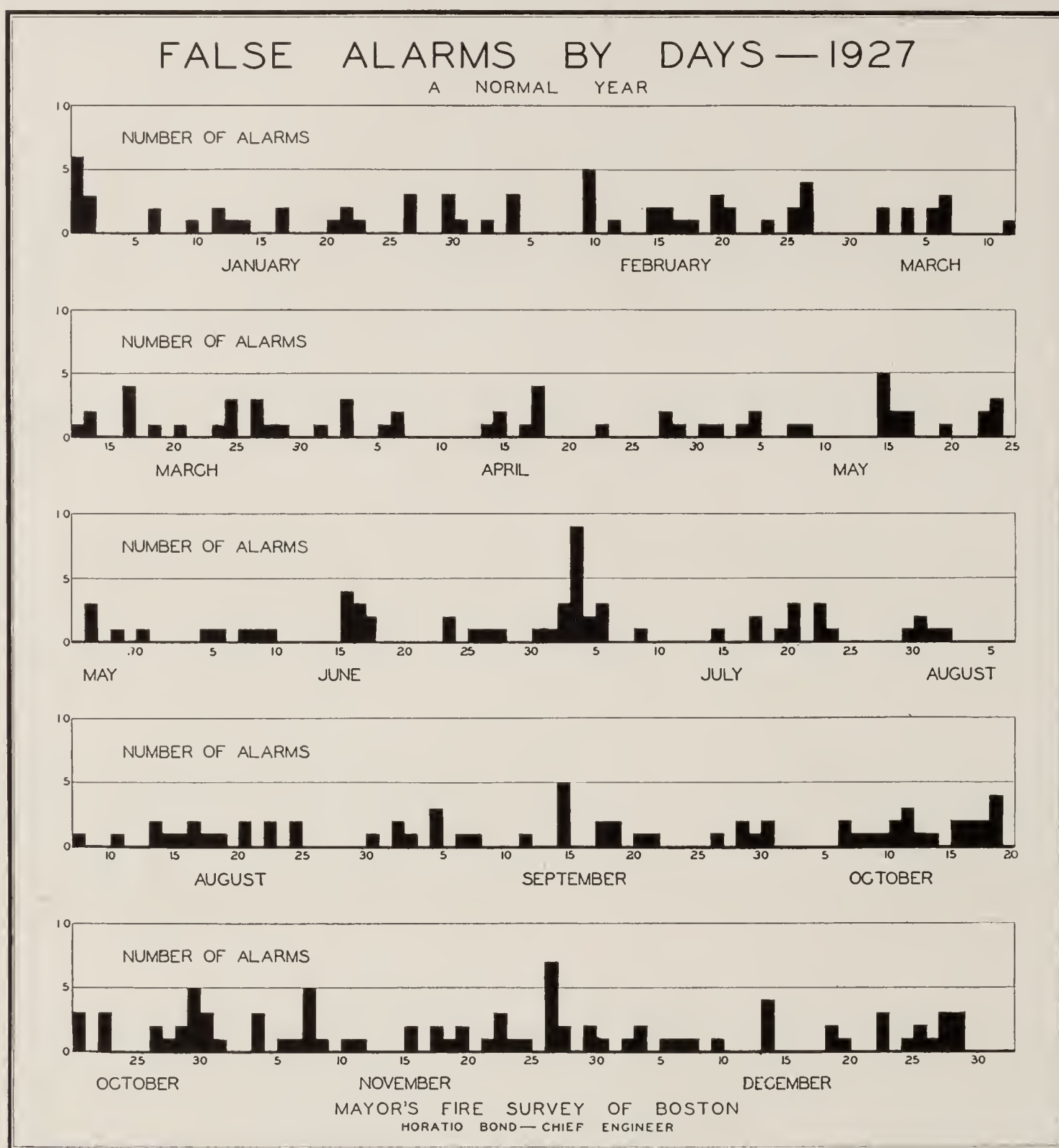


FIGURE 108.

Locations in Which Alarms Occurred. To localize the areas affected by the epidemic of false alarms, a spot map of the 652 false alarms was made. (Fig. 111.)

The map shows that the greatest activity was in Jamaica Plain, Roxbury, Dorchester and Charlestown, with some activity in South Boston, East Boston and Brighton. There was very little in West Roxbury, Hyde Park, the Back Bay or the city proper (excepting the North End).

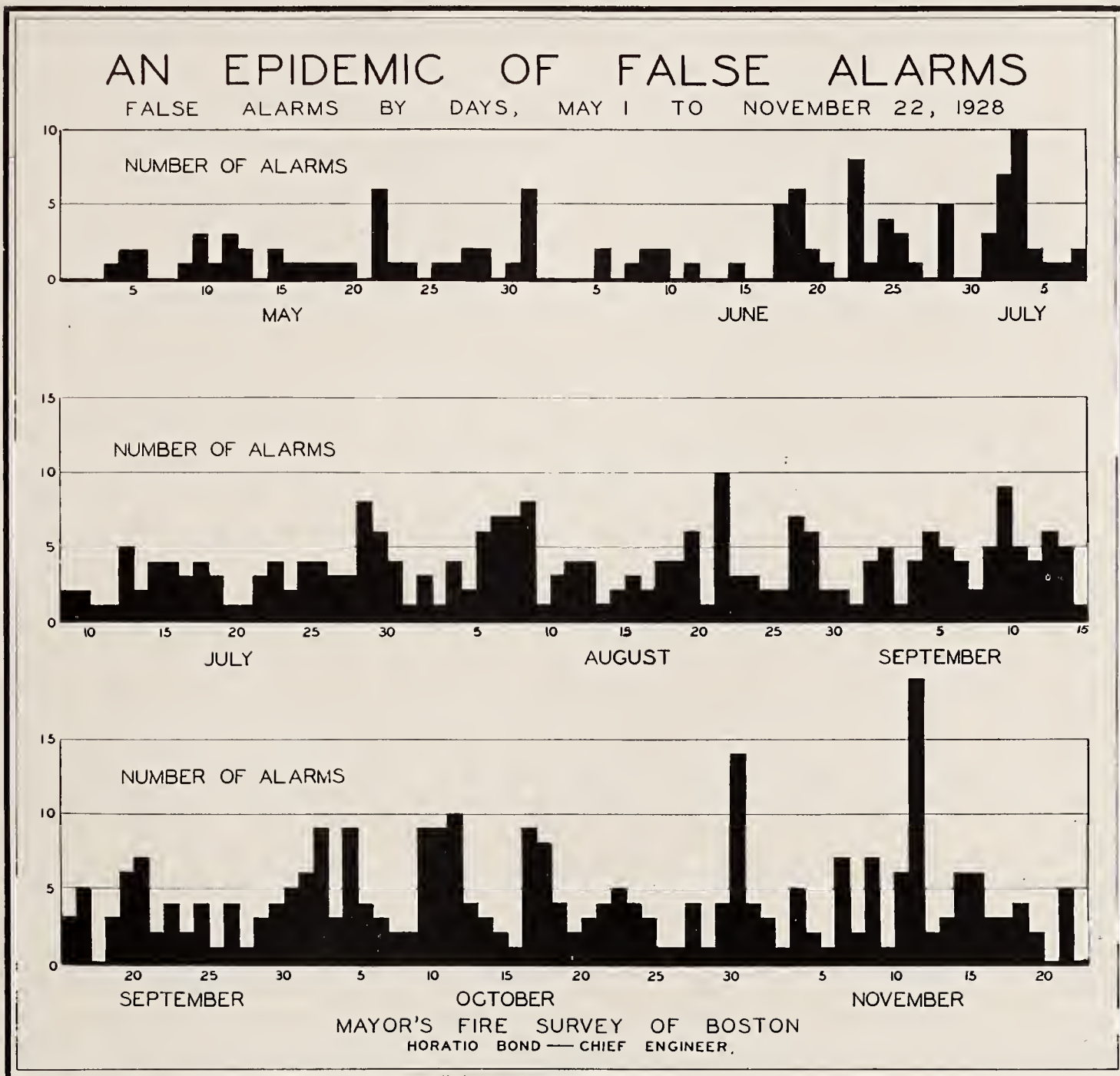


FIGURE 109.

The study of false alarms suggests several localities which may be the "headquarters" from which gangs operate. These locations may suggest to the officials of the Police and Fire Departments in these districts what groups of known mischief-makers may be responsible. These approximate locations are:

1. Between Chestnut and Columbus Avenues, north of Egleston Square.
2. Slightly further north between Heath, Bickford, Centre and Day Streets, Jamaica Plain.
3. Several blocks near Shawmut Avenue and Vernon Street, near the Dudley Street Terminal.

4. In the vicinity of Blue Hill Avenue, Quincy, Magnolia and Lawrence Streets, Dorchester.
5. Pierce Square, Dorchester.
6. Peabody Square, Dorchester.
7. Several blocks each side of Bowdoin Street, southwest from Meeting House Hill.
8. East of Dorchester Avenue, between Dix and Lonsdale Streets.
9. Area bounded by Freeport Street, Victory Road, and the Old Colony Division tracks.
10. Medford Street, eastern end, Charlestown.

In the Appendix (Table 5 J) is a list of boxes from which false alarms were pulled 3 times or more during the period studied.

Time of Day. Fig. 112 shows the time of day at which false alarms have been pulled. In the epidemic period there were more alarms in the afternoon and early evening than normally. This suggests that school children might be to some extent responsible. The increase in false alarms around noon and 5 o'clock p. m. are usually attributed to children on the streets and persons going to or coming from work.

Police Activities. Through the courtesy of Superintendent Michael H. Crowley of the Police Department, data on the number of arrests and the disposal of the cases of persons charged with pulling false alarms between May 1 and December 8, 1928, was made available.

Out of 67 offenders 92 per cent. were minors arrested for alarms pulled in August, September and October. Practically all minors punished were merely placed on probation — mostly for a 6 months period. Two were fined \$50.

One adult was sentenced to 3 months in the House of Correction, but on appeal this was reduced to 10 days. Another adult got 10 days for pulling an alarm while drunk, while another was let off with a \$5 fine. Three men aged 20 and 21 were sentenced to 2 months in the House of Correction, but their sentences were suspended. One adult was sent to the Psychopathic Hospital.

Taking the city as a whole only about 8 per cent. of the alarms pulled were accounted for by the arrests made. Police Division 7 showed commendable action, apprehending individuals responsible for 19 alarms out of the total of 48 pulled in East Boston.

If Division 7 can account for 40 per cent. of their false alarms the others should do better than an average of 8 per cent. In Divisions 6, 7, 9, 10, 11, 13, 14, 15, 17 and 19 increased police activity is necessary, particularly in Divisions 9, 10 and 11. (See Appendix 5 K.)

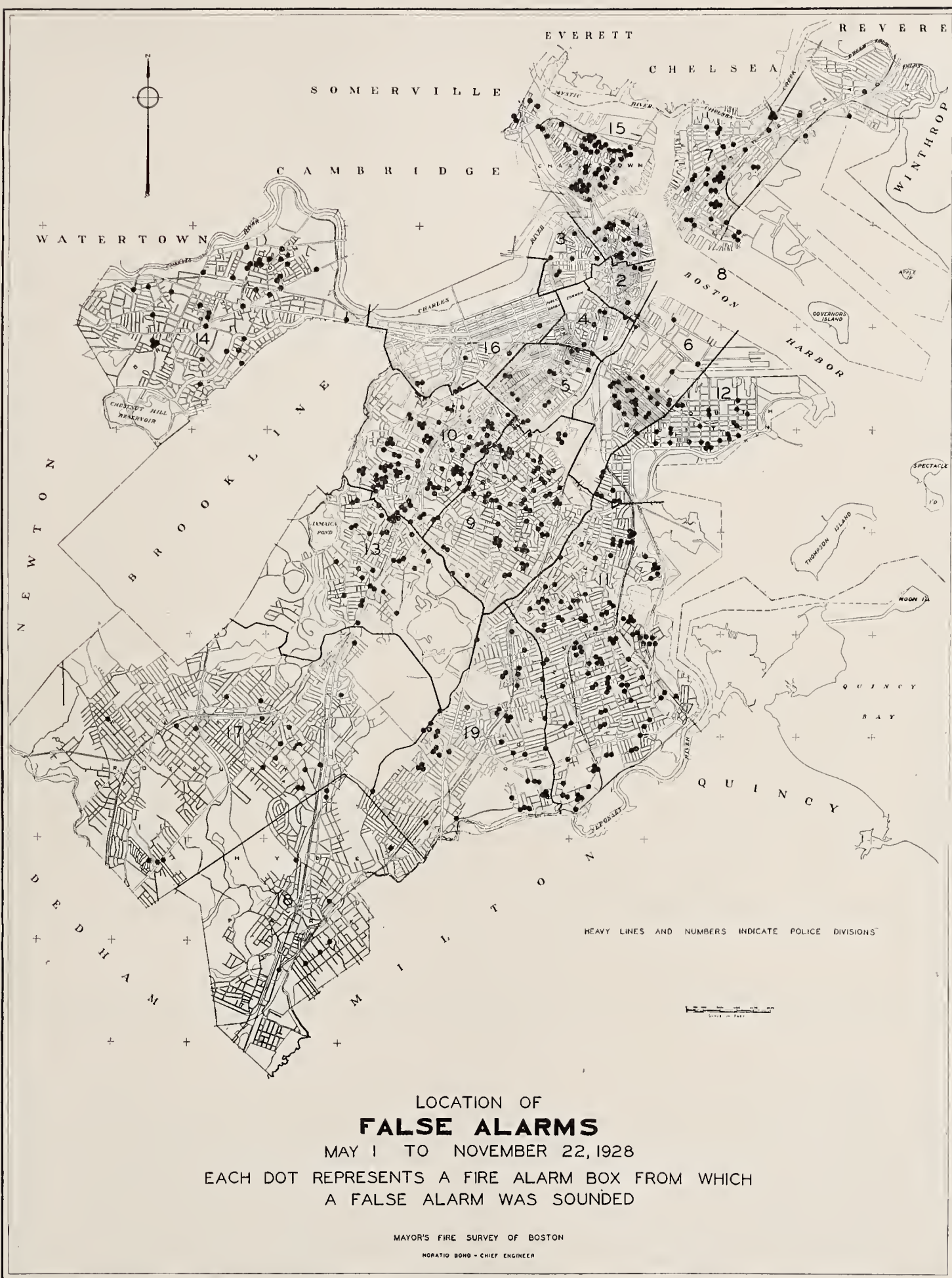


FIGURE 111.

(111)

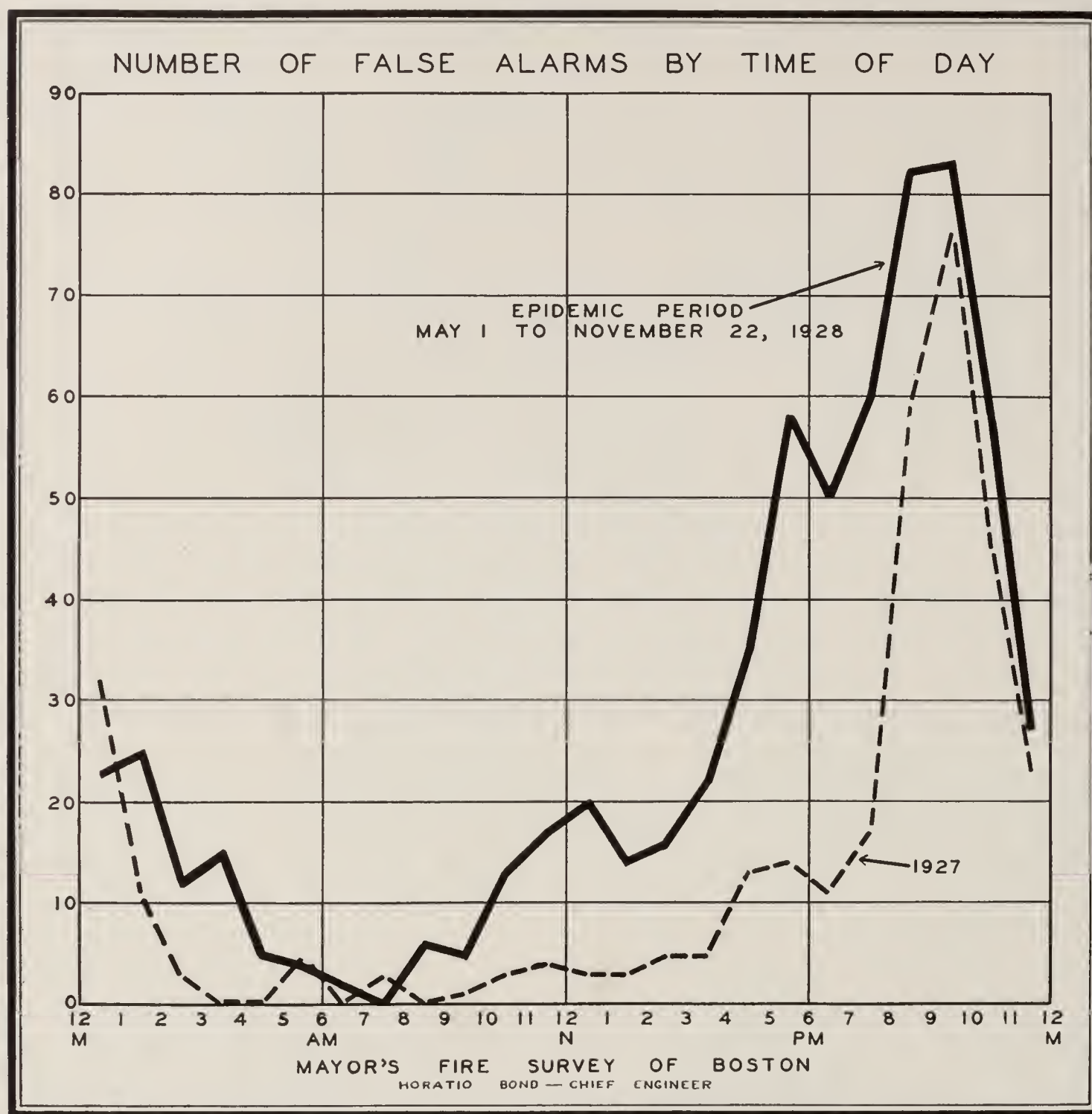


FIGURE 112.

Recommendations. 1. This study has localized the general areas from which gangs apparently operate in systematically pulling false alarms. Police having jurisdiction very likely know what gangs of mischief-makers are to be found in these areas. It is also likely that the persons who pull false alarms are familiar with the fire department activities—they may frequently hang around fire stations and may be well known to the firemen in these neighborhoods. The police and firemen should compare notes in respect to such individuals and work together to apprehend them.

2. The boxes frequently pulled should be studied by the fire alarm division of the Fire Department, to see if by some slight relocation, or improved lighting the temptation to pull them can be reduced. In this matter the Public Works Department, which has charge of the lighting of the boxes, should cooperate.

3. Special watching of boxes on holiday evenings should be undertaken. The fire and police departments together could provide most of the men necessary for this work, and a number of older boys from Boy Scout troops might be available to make up the necessary detail.

4. The police divisions where many false alarms have been pulled should be stimulated to greater activity.

5. The punishment of adults for pulling alarms falsely seems inadequate. Most of the minors convicted were put on probation which may be the best way to deal with these cases. In the case of adults the heaviest punishment outside of fines was ten days imprisonment. Severer sentences and heavy fines should be applied to adults especially.

6. Many of the alarms are pulled by minors, some of them as young as seven years. These can best be prevented by education in the schools. An objection to this has been raised on the ground that it has been tried each year during Fire Prevention Week, and usually results in an increase in false alarms at that time. There seems to have been no special increase in 1928 other than that of the Columbus Day holiday. If in some years there has been an increase it has been because the pulling of alarms has been given an undeserved importance in the pupil's mind because he only hears about it once a year. If instruction about the fire alarm box and its functions were given as a part of regular courses in fire prevention the pupil would thus be taught how to use it in an emergency, and would not be so strongly tempted to pull it unnecessarily.

CHAPTER 6

FIRE LOSSES AND BUSINESS CONDITIONS

This chapter is a purely statistical study of the fire losses in Boston by months for the last 30 years, presented to show the trend of losses and to compare them with business conditions. This will show first what the trend of fire losses in Boston has been as compared with the rest of the country. Comparing the fire losses with business conditions will show to what extent during the last 30 years poor business conditions have been reflected in high fire losses. The extent of correlation between poor business conditions and high fire losses will establish the relative importance of arson as a factor in causing Boston's fire losses.

Fig. 115 shows the annual fire losses in Boston, 1898 to 1927, inclusive. These figures, obtained from the Annual Reports of the Boston Fire Department, represent losses based largely on insurance paid, as reported by the Boston Protective Department. (Appendix 6 A.) Figures for the losses are obtainable in monthly form.

Fig. 115 shows that fire losses have been steadily mounting during this period, but that since 1923 there has been a distinct downward movement. It further shows that the greater part of the fire losses are losses on the contents rather than on buildings, contents averaging 60 per cent. of the total losses.

Because of the changing value of the dollar during this 30-year period, the dollar values of the losses cannot properly express the relative amount of physical material burned from year to year. To see how far the increasing losses as expressed in current dollar values truly represent the physical amounts burned, these figures must be corrected, or "deflated," to allow for the changing values of the dollar.

This was done by dividing the losses on buildings by an index of building costs, and the contents losses by an index of commodity prices. Indices are available in which prices in 1913, the mid-year of the series, are taken as 100.¹

These respective indices having been applied to losses on buildings and losses on contents the total of their thus "deflated" values was plotted, in Fig. 116, against the actual dollar values of the losses taken from Fig. 115. This plot shows that the dollar values materially exaggerate the relative amount burned in recent years.

¹ The Index of Wholesale Prices of the United States Bureau of Labor Statistics, made up from the prices of some 400 items, was used to deflate the contents losses. In deflating the losses on buildings the *Engineering News-Record* Index of Construction Costs was used for the months subsequent to October, 1915, and for the months prior to that date the United States Bureau of Labor Statistics' Index of Wholesale Prices of Building Materials was used. While these latter indices are nearly the same for most of the 30-year period, the *Engineering News-Record* index seemed best for the latter period of the series, as it contains as one factor the cost of labor, which is not included in the Bureau's index, and which has materially affected construction costs in recent years.

The “deflated” monthly loss figures are plotted in Fig. 117. This curve is of especial interest because it shows the influence of large fires in the fluctuations from month to month. In Appendix 6 B is a list of large individual fires which explain some of the largest monthly losses, particularly those over \$500,000 a month.

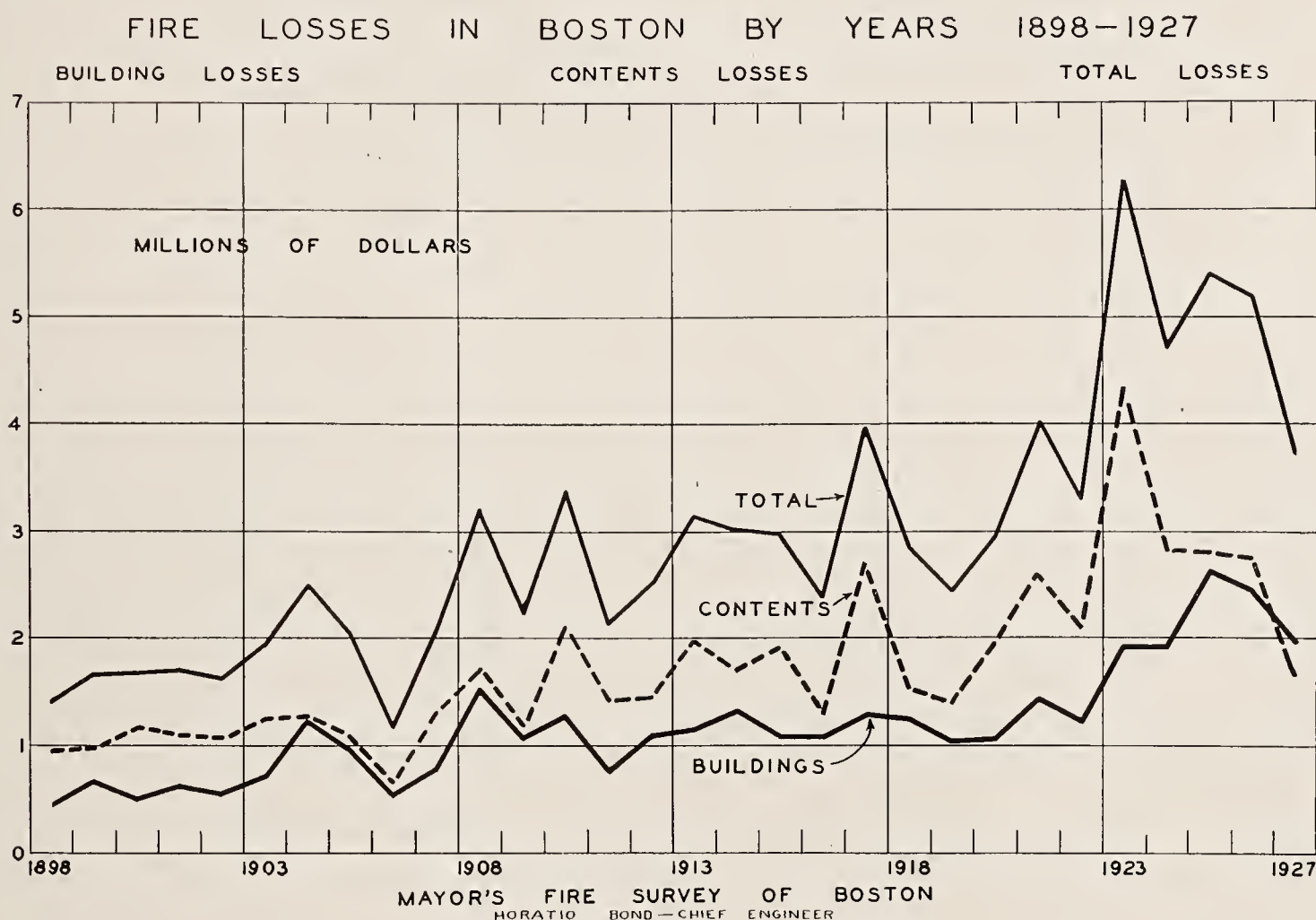


FIGURE 115.

“Secular” or Long-Term Trends. From observation of Fig. 117 it is apparent that the general trend of losses in this 30-year period is best represented by a straight line. The straight line trend was calculated mathematically¹ and shows a small but steady increase in the relative amounts burned. This trend is slight as compared to that which was shown by the plot of actual dollar values. (Fig. 116.)

The increase is only \$21,000 (deflated value) in the 30 years, or about \$700 a year, a negligible rate of growth in comparison to the annual losses. Accordingly it may be observed that there exists in Boston a long term tendency for the physical amount burned to remain relatively constant.

¹ No attempt has been made in the text of this chapter to describe in detail the statistical methods followed. These are given for readers interested, in Appendix 6 C.

Although they are not reproduced here, similar plots were made for the deflated monthly values of contents losses and building losses, and the trends determined. Contents losses, as might be expected, showed wider fluctuations than building losses. The trend of building losses was very slightly downward, while the contents losses were slightly upward, the sum of these two trends being the slightly upward trend of total losses shown in Fig. 117. These trends are so slight that they may be neglected in the following statistical analysis.

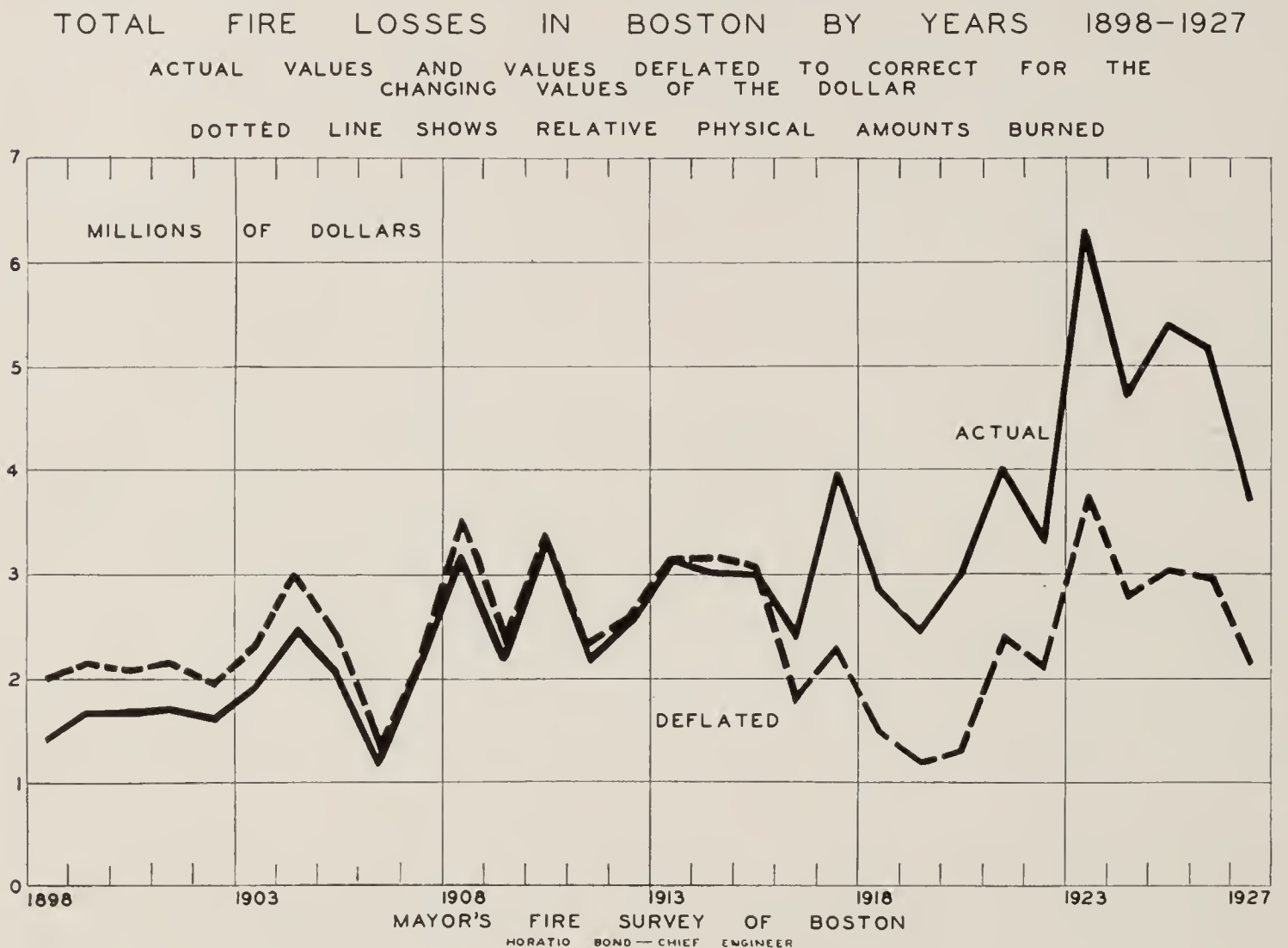


FIGURE 116.

Seasonal Variation. Fig. 117 showed that the amounts burned seemed to have a definite seasonal variation, being noticeably greater in the winter months as might be expected. Fig. 118 shows typical monthly values for the losses during the 30 years. These are median¹ rather than average values, as the latter would be too much influenced by the big fires. The greatest losses come in January, decreasing to a low point in June, but having a marked peak in July, dropping to another low in September, and increasing steadily to January again. Fig. 118 also shows typical monthly losses on buildings and contents.

¹ A median value is a figure so chosen that half the individual numbers in the series are greater and half are less. It is generally more representative a value in statistical work than a straight average.

The movements shown in Fig. 118 are therefore the normal movements of losses that may be expected from month to month. From the values plotted in Fig. 118, an index of seasonal variation was determined by taking the average of the monthly total losses, \$168,400, and calling it 100 per cent. The other monthly losses are proportioned thereto, thus producing an index of the normal fluctuations in losses from month to month.

TOTAL FIRE LOSSES IN BOSTON 1898-1927

DETERMINATION OF SECULAR TREND OF MONTHLY DEFLATED VALUES

MAYOR'S FIRE SURVEY OF BOSTON
HORATIO BOND—CHIEF ENGINEER

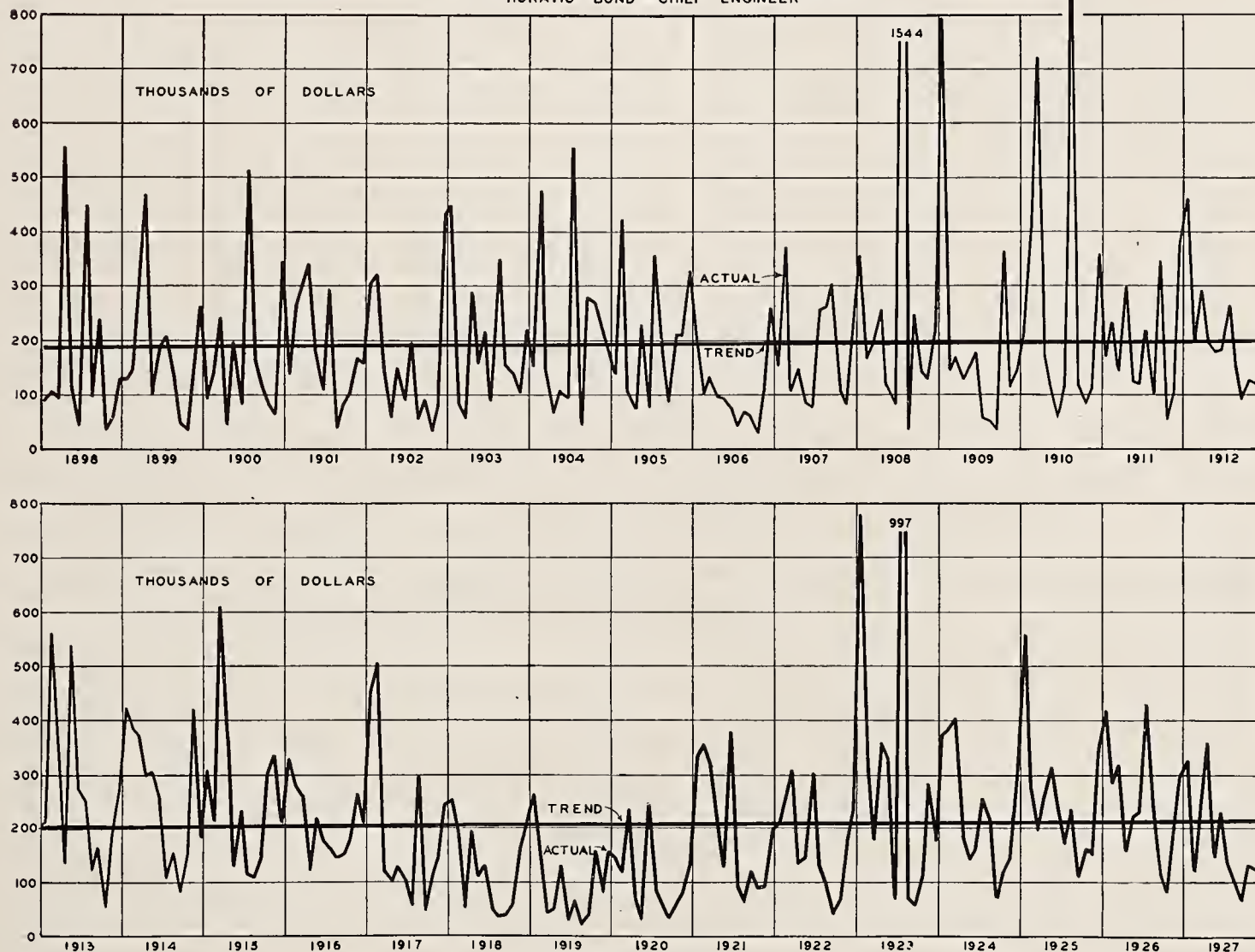


FIGURE 117.

Cyclical Fluctuations. Because the secular trend of the deflated monthly losses for the 30-year period was substantially a horizontal straight line, the monthly loss value at the mid-point of this line could be taken as the normal, and expressed as 100 per cent. The other monthly deflated values could then be expressed in terms of per cent., by relating them to this normal. The figures thus obtained are the losses for any given month expressed in per cent. of an average or normal month.

To obtain a curve that will show only the abnormal or "cyclical" fluctuations in losses from month to month it is necessary to eliminate that portion of the loss in each month that may be considered to be normal for the month. This could be done by dividing each of the monthly loss figures, now expressed in percentages, by the index figure typical of the respective months, which is also expressed in percentages (Index of Seasonal Variation).

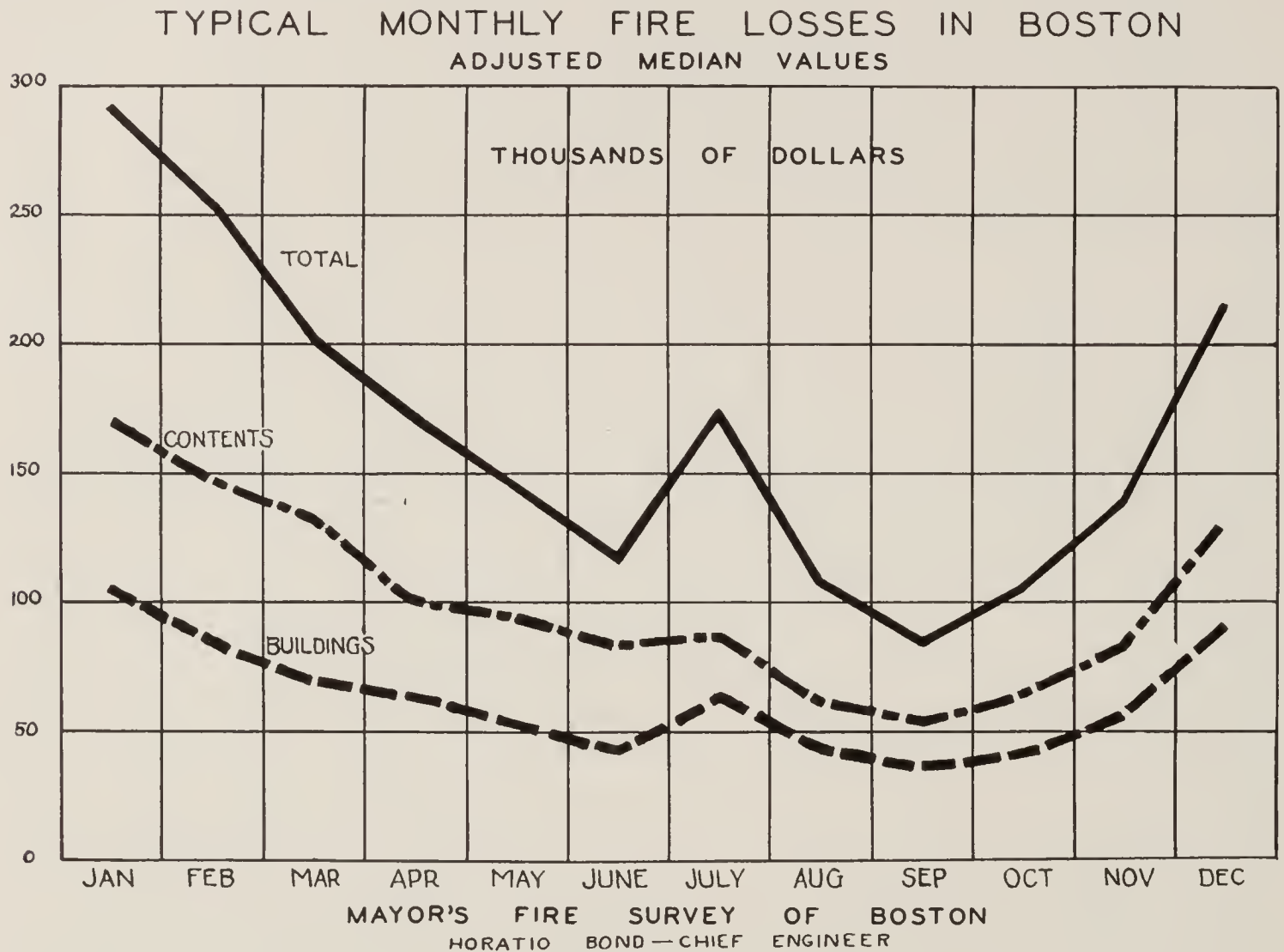


FIGURE 118.

Fig. 119 (light line) is a plot of the resultant figures. It shows variations in the monthly fire loss values which cannot be explained by (1) the changing value of the dollar, (2) the long-time trend, or (3) the seasonal variations, all these factors having been corrected for.

The corrected loss values shown in the light solid line in Fig. 119, showed such wide fluctuations from month to month that it was desirable to develop from them a somewhat smoother curve. This was done by taking a 7-months' moving average¹ of the plotted values. The curve thus obtained is shown in the heavy line in Fig. 119, and will be used in future comparisons.

¹ A 7-months' moving average produces a figure for each month which is the average of 7 months, including the figures for the 3 months preceding, the figure for the month itself and the figures for the 3 months following.

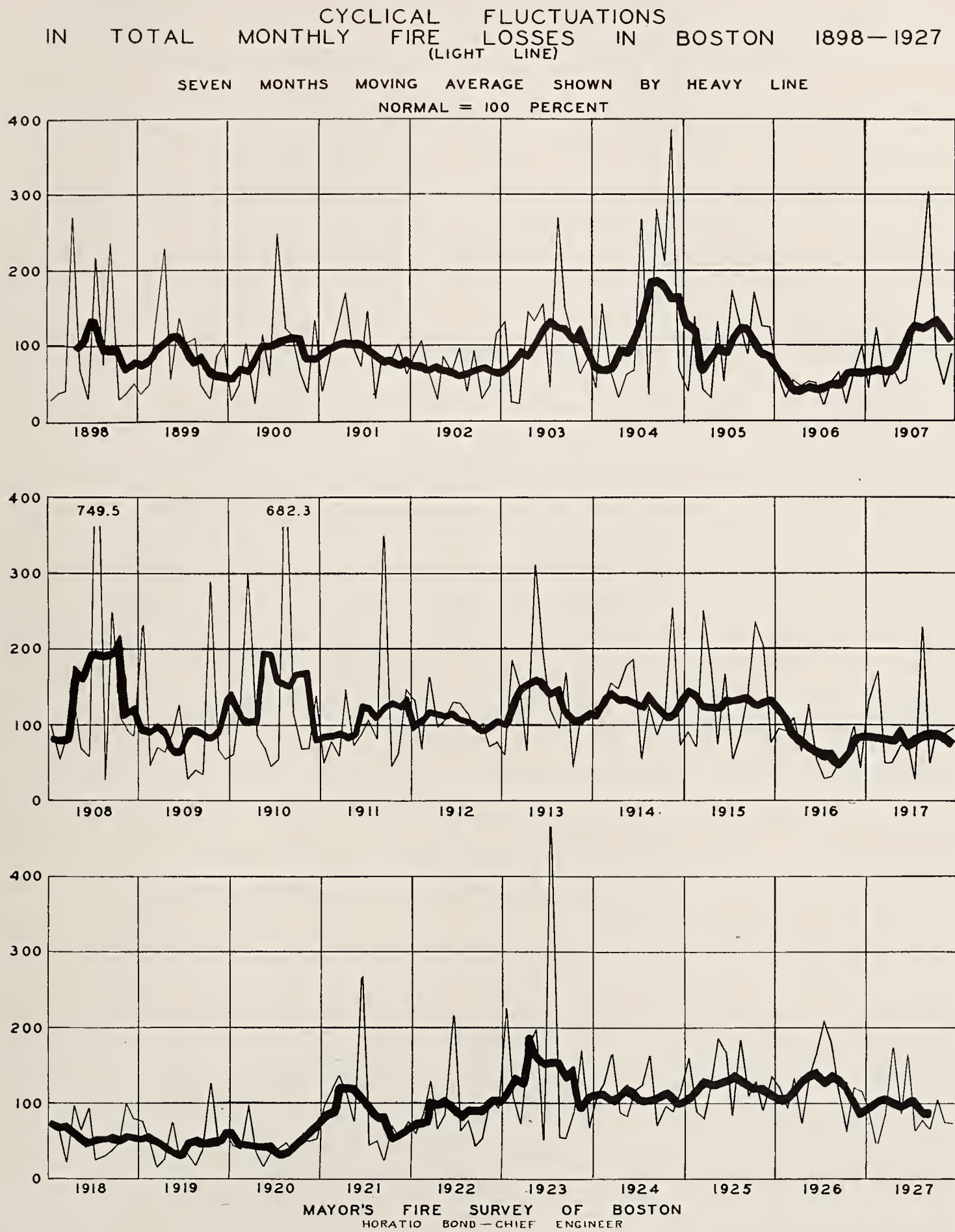


FIGURE 119.

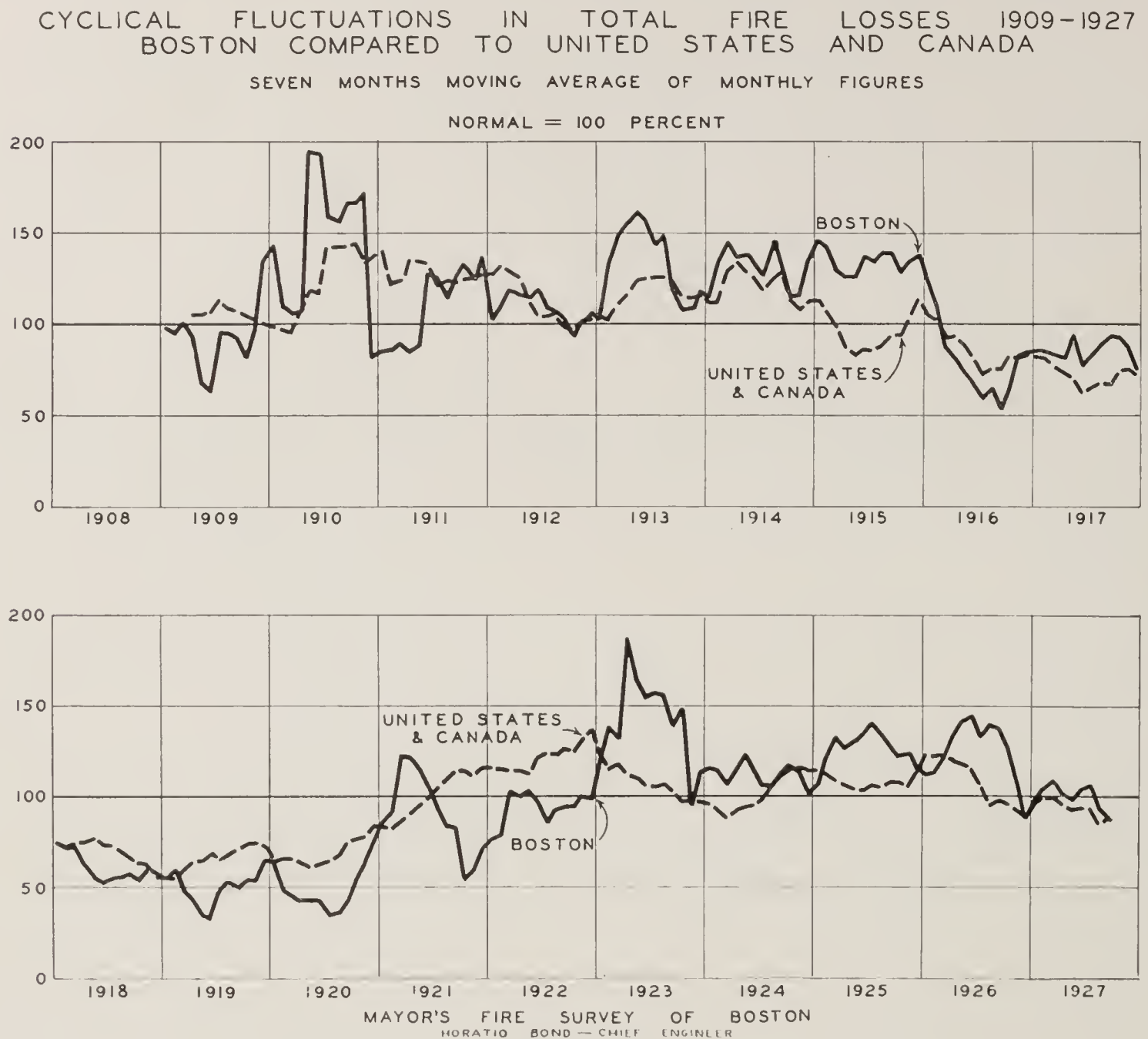


FIGURE 120.

COMPARISON OF BOSTON RECORD WITH RECORD OF UNITED STATES AND CANADA

The curve in Fig. 119 shows the cyclical or "abnormal" fluctuations in Boston's fire loss. An exactly similar curve outlining the cyclical fluctuations in the losses for the United States and Canada was prepared for the last 19 years of the series. This is shown plotted against the Boston curve in Fig. 120.

The monthly loss figures reported by the *New York Journal of Commerce* were used in preparing this latter curve. These original values not being divided between buildings and contents, an average of the indices of construction costs and commodity prices was used in "deflating" them to correct for the changing value of the dollar. As with the Boston losses, the trend could be neglected,

but the effect of seasonal variation was eliminated, the results expressed in percentages and seven months' moving averages were computed and used in plotting the curve shown.

The curves on Fig. 120, therefore, give a reasonably satisfactory comparison of the cyclical fluctuations of the two series.

As might be expected, these fluctuations are more marked in the Boston record than in that of the United States and Canada, but the general movements of the two curves are practically identical. In 13 of the 19 years plotted, the movements closely correspond. There were slight differences in 1909 and 1911. In 1915 Boston's record was well above that of the country, in 1922 it was much lower. The Boston peak of 1923, influenced somewhat by a single large fire, came only a few months after the countrywide peak of December, 1922. Peaks in the curve of countrywide figures came in the winters of 1924-1925 and 1925-1926, but were followed by peaks in the Boston record in the summers of 1925 and 1926.

These curves show that whatever influences affect losses in the United States and Canada, these same influences are at work, and at relatively the same times, in Boston as well. It may be concluded therefore that general business conditions which affect the fire losses of the country as a whole would have a similar effect, possibly different in intensity, upon the losses in Boston.

COMPARISON OF CURVE OF BOSTON FIRE LOSSES WITH HARVARD "B" CURVE¹

The "B" Curve of the Harvard Economic Society, is an accepted index of general business conditions in the United States. It is used in this study, through the courtesy of the Society. In Fig. 122 this curve is plotted against the curve of fire losses in Boston. As the "B" curve is expressed in units of one standard deviation,² the standard deviation for the Boston loss curve of Fig. 119 was computed, and the actual fluctuations above and below the base line of zero were determined.

Comparison of the curves in Fig. 122 should show to what extent business conditions of the country as a whole influence the local fire losses in Boston. As the business curve reflects national conditions while the fire loss curve is representative of a local condition, too much correspondence between these curves should not be expected. However, examination of Fig. 122 shows that there is a general tendency toward high fire losses in times of poor business and low losses when business conditions are good.

¹ The comparison of Boston fire losses with the Harvard "B" curve was necessary as no other index of business conditions for the entire 30 years was available. A comparison of the losses with a local index for 10 years only is made later.

² The "standard deviation" of any series is a certain number of units above and below the 100 per cent. line (see the curve of Fig. 119 by way of example). Two lines, one above the 100 per cent. line and one below, each parallel to and equi-distant from it are drawn so that two-thirds of the plotted values fall between them. The position of these lines may be computed mathematically. The number of units between the 100 per cent. line and either of these parallel lines is the "standard deviation." This standard deviation determined, the other plotted values may be expressed in terms of it.

COMPARISON OF BOSTON FIRE LOSSES AND GENERAL BUSINESS CONDITIONS AS EVIDENCED BY HARVARD "B" CURVE 1898—1927

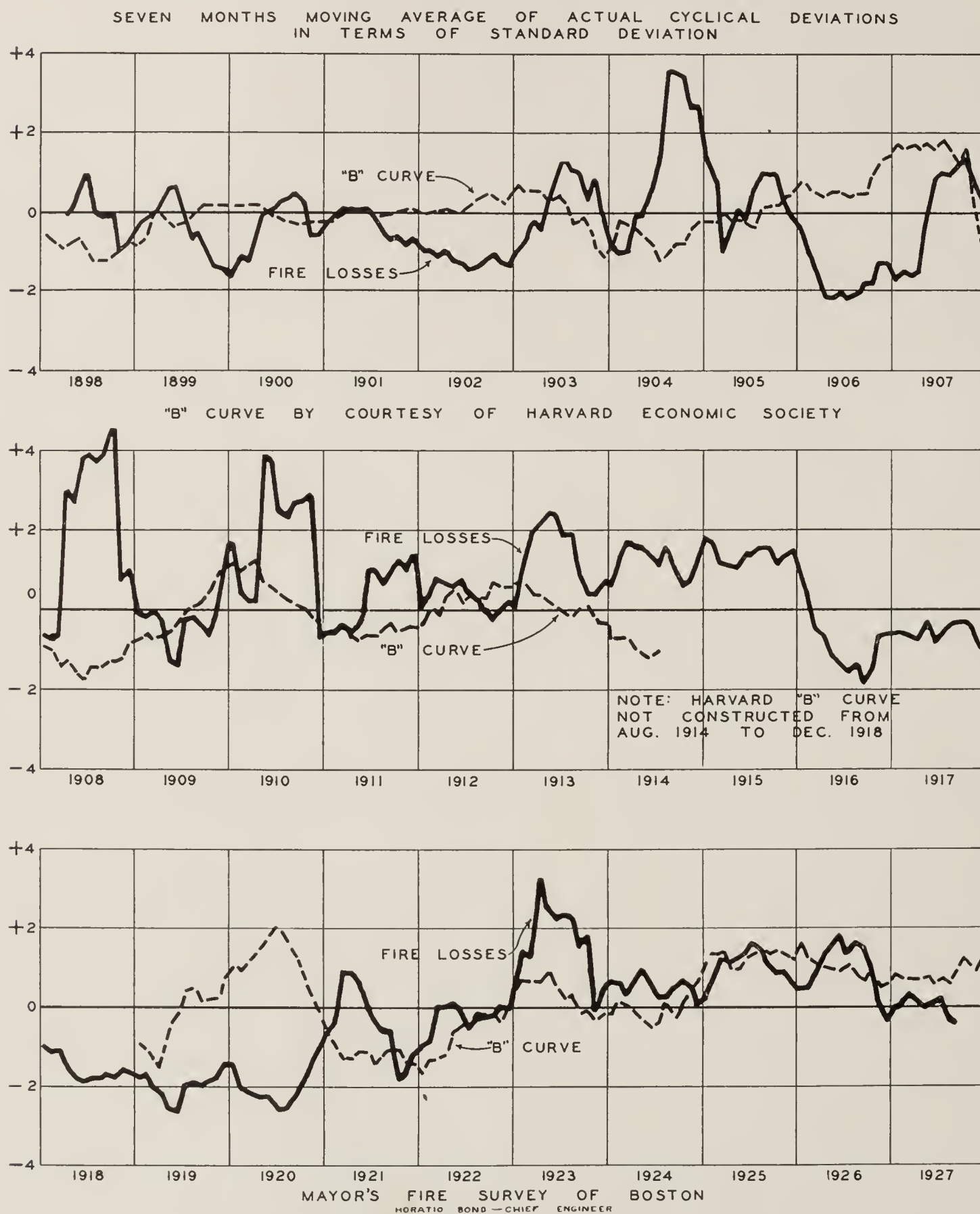


FIGURE 122.

In the first 6 years shown, business conditions are steadily improving, while losses are steadily going down. In 1903 and 1904 business slumps and losses mount. During the good business conditions of 1906 and 1907 the losses are low, but losses rise as business slumps toward the end of 1907 and through 1908. Recovery of business in 1909 brings the fire losses down again, but with another recession in 1910 reaching a low in 1911, losses are high. In 1912 with business improving, losses are decreasing. The high losses in 1913 and 1914 correspond to a downward tendency in the "B" curve.

From 1914 to 1918 the Harvard "B" curve was not constructed, because conditions during the war period made any index unreliable. Low losses in 1919 and 1920 were coincident with good business, but the period of business depression in 1921 sent the losses upward, a tendency that continued through 1922 and 1923, years when business was recovering but still uncertain. In 1925 and 1926 Boston losses were high although business conditions for the country as a whole were good.

A more detailed study of these curves confirms the conclusions that local fire losses are definitely affected by general business conditions. In 20 of the 26 years for which the comparison is possible, fire losses increased when business declined and dropped when business was improving.

In only 6 of these years were these corresponding tendencies not clearly apparent. In 1898, 1909 and 1922 the movements of the curves are such that it is hard to estimate the actual trend for the one year in question. In the other 3 years, 1921, 1925 and 1926, there seems to be tendencies definitely opposite to those of most of the other years.

The marked reaction of local fire losses to general business conditions is significant, as there seems to be no reason why they should necessarily so react. It is equally significant that the fire losses should respond to business conditions at nearly every period of the last three decades. Most significant of all are the extraordinary peaks of losses coming directly following major declines in business conditions (1903-1904, 1908, 1910, 1913, 1920-1921 and 1923).

These facts lead to the important conclusion that general business conditions are an important factor in Boston's fire losses, due to their obvious effect on business conditions in Boston.

COMPARISON OF BOSTON'S FIRE LOSSES WITH AN INDEX OF LOCAL BUSINESS CONDITIONS

That there is a direct correlation between business conditions and the fire losses in Boston has been established by the comparison of the Boston loss curve with the Harvard "B" Curve.

This correlation was definitely apparent for all but six of the years for which the comparison was possible. In only two, 1925 and 1926, were the fire losses

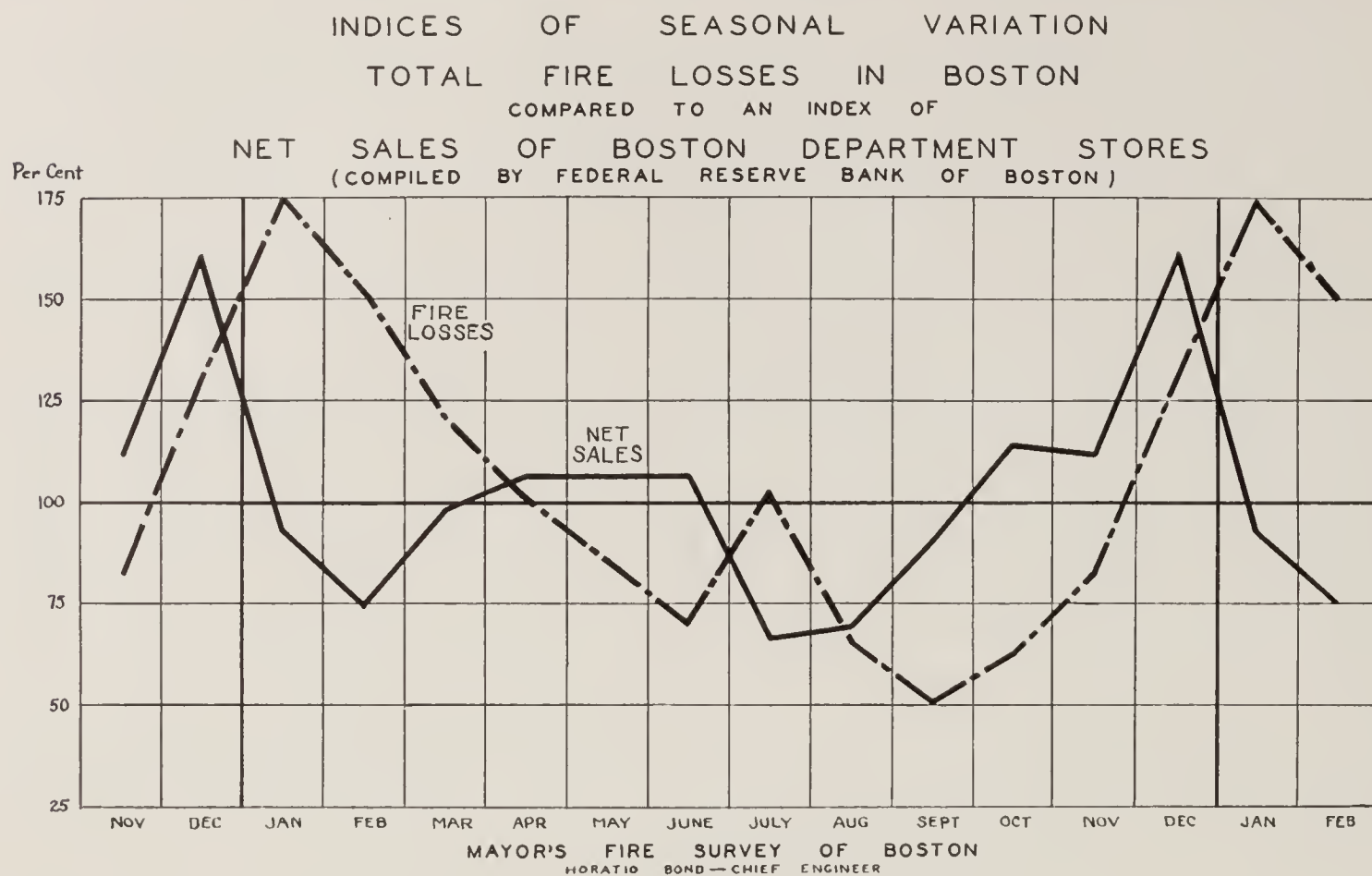


FIGURE 124.

high when business conditions were generally good. The following comparison of the Boston loss curve and an index of local business conditions showed that local conditions in these two years were somewhat different from national conditions, and that the fire loss responded to the local conditions in these two years as it had to the national conditions in the other years.

The one series of available figures which seemed a reliable index of local business conditions was an index of the monthly Net Sales of Department Stores, compiled from figures reported by the larger department stores of the city to the Federal Reserve Bank of Boston. The sales of department stores should reflect business conditions from month to month to a marked extent. When business is good, the public has money to spend, and a buying spirit, both of which are lacking when business is depressed.

The sales of department stores are used in this study solely as an index. The department stores as a class have an excellent fire record.

Seasonal Variation. The index of the seasonal variation of the curve of Net Sales is shown in Fig. 124, with the index of seasonal variation of total Boston fire losses obtained from Fig. 118. As both sets of figures are expressed in percentages, they may be plotted on the same scale.

It is to be noted that the peak of fire losses occurs in January, the same month in which sales drop precipitously from the December peak. Also that

fire losses continue to decline until June but rise sharply in July, the month in which sales again drop sharply to the low for the year. Sales begin to pick up slowly in August and fire losses drop off. When fire losses reach their low for the year, sales have increased sharply in September and the fall selling season is under way.

The rise of fire losses during the fall, reaching a high point sometime during the winter is to be naturally expected due to the increased fire hazards of the colder months of the year. But it is contended, on the basis of Fig. 124, that the fire loss peak would not be as high in January were it not for the fact that business conditions of that month are generally much slacker than in December. In support of this contention is the similar coincidence of poor business conditions and high fire losses during the month of July.

In addition it should be noted that December 31 is the end of the business year for most concerns, more so now than previously because of the necessity of making out income tax returns for the calendar year where at all possible. Furthermore, many concerns take a mid-year inventory and balance their books semi-annually, as of June 30. Thus, it is inevitable that during the months of January and July the majority of businesses should know how they stand, how much inventory they are carrying, and how large an amount of obsolete stock is on their hands. Since business conditions and fire losses have exhibited a close correlation, in previous sections of this study, and do so again here when a Boston business curve is compared with Boston fire losses, Fig. 124 serves only to confirm particularly what has been proved more generally.

Cyclical Fluctuations. The index of department store sales is plotted, in Fig. 126, against the curve of Boston losses from Fig. 119. In the loss curve of Fig. 119, the effect of seasonal variation was eliminated, so in the curve of department store sales the seasonal movements shown in the index in Fig. 124 have likewise been removed. The correlation of the seasonal variations of the two curves has been discussed under the preceding heading, so Fig. 126 is a comparison solely of the cyclical or "abnormal" fluctuations in each series, which are not already accounted for by seasonal fluctuations.

Fig. 126 shows that the fire losses respond to local business conditions much more readily than to general conditions. The major peaks in the loss curve correspond, with few exceptions, to the depressions in the sales curve and *vice versa*. These corresponding tendencies even occur in many of the minor movements of both curves, which further emphasizes the general deductions made from this study.

Business improving in 1919 and being high in 1920, the losses in these years were low. But as business went into a decline late in 1920 losses immediately took a marked rise, but dropped during the summer of 1921 as the business

curve showed signs of leveling off. They rose again, however, when business again declined, but checked as business began to pick up in 1922. The slump in business late in 1922 apparently prompted the startling peak in losses in 1923. Losses fell off, however, as business was improving during most of 1923, but this drop was checked as business declined during 1924. The precipitous decline in business in early 1925 sent losses mounting, but the losses lessened as business picked up again. These movements were repeated in 1926, 1927, and 1928, although the 1927 peak of losses was less pronounced than that of the two preceding years.

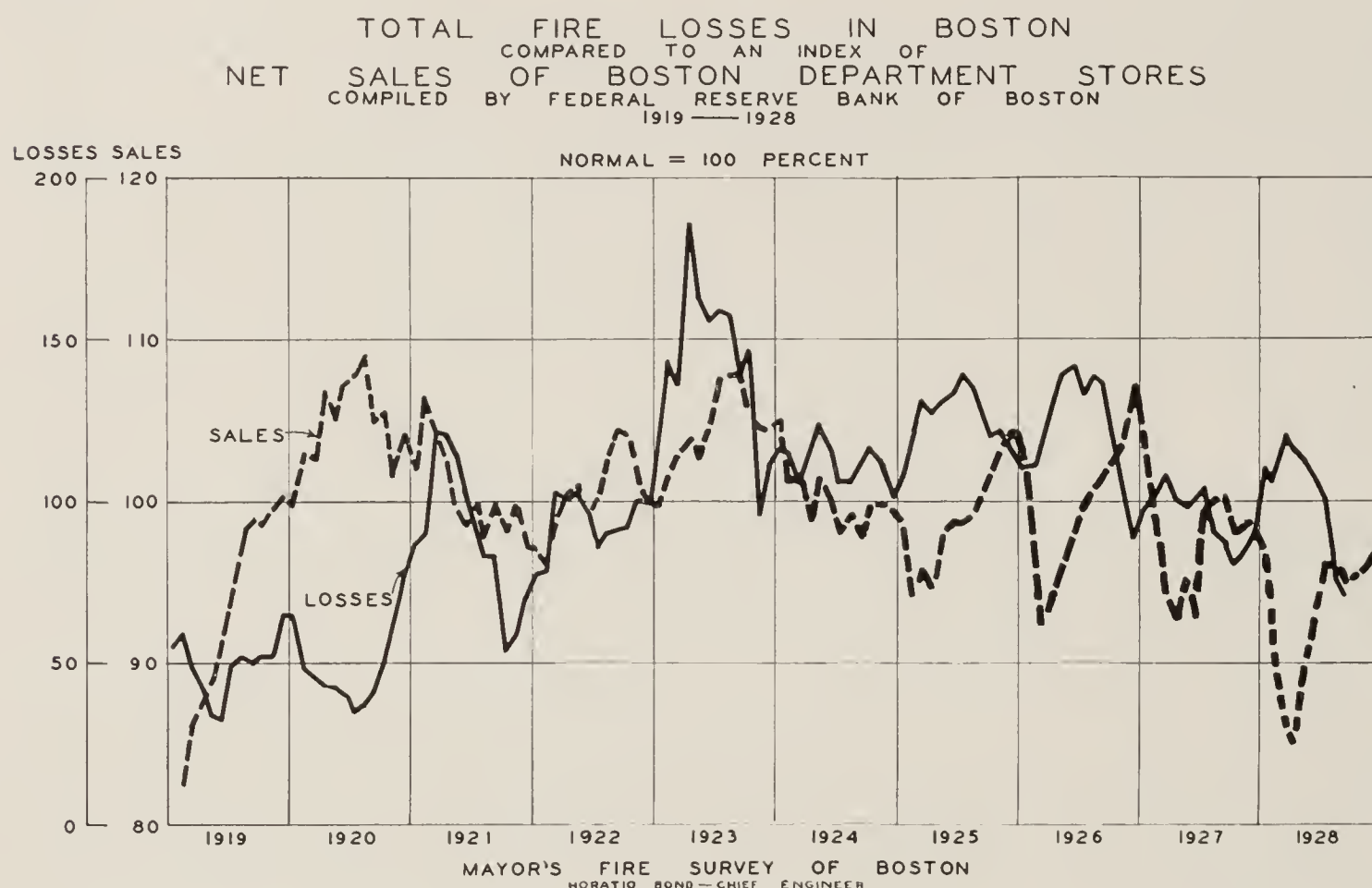


FIGURE 126.

(Figures for 1928 became available in time to be used in the above chart only.)

These curves provide the explanation of why the 1925 and 1926 records did not follow general business conditions as exemplified by movements of the "B" curve. The losses, did, however, respond exactly to local business conditions.

Fig. 126 will be considered further in connection with a discussion of local activities in prosecuting arson, in Chapter 11, "Investigation of Fires."

CONCLUSIONS

The following are the major conclusions of this chapter:

1. Boston's fire losses, though apparently rising rapidly, are, in reality, doing so very slowly, when the changing value of the dollar is considered.

2. Contents losses are generally about 60 per cent. of the total, fluctuating between 50 and 70 per cent.

3. Building losses are decreasing very slowly, but contents losses are increasing, making total losses increase slightly over the 30-year period.

4. A comparatively small number of large loss fires has played a conspicuous part in raising the total losses to the figures shown in the records of the 30 years.

5. Boston's losses (deflated to adjust for variations in value of dollars) have been rising slightly whereas the losses of the country as a whole have been dropping.

6. The seasonal variations and the cyclical fluctuations of Boston's fire losses and those of the country as a whole are comparatively similar, although the former fluctuate more widely than the latter.

7. Boston's fire losses are high when business is depressed, and *vice versa*.

8. The remarkable coincidence between the periods of prosperity and depression of business and of low and high fire losses respectively, leads to the conclusion that arson, or incendiarism, plays a large part in the record of the fire losses of Boston. The indifference to good housekeeping and fire safety which follows unprofitable business, thus relaxing care and permitting preventable fires to start, is probably a factor to some extent as well.

CHAPTER 7

THE FIRE DEPARTMENT

The Boston Fire Department consists of a headquarters' force, fire force, fire alarm division, division of maintenance and supplies, division of fire prevention, and a wire division. Except for the headquarters' force, division of fire prevention and wire division, the department is on a 2-platoon basis.

Fire Commissioner and Organization Details. The Fire Commissioner is the executive head of the department, as is clearly defined in chapter 18 of the statutes relating to the City of Boston as follows:

“SECTION 2. The fire commissioner shall have the charge of extinguishing of the fires in said city and the protection of life and property in case of fire, shall purchase and keep in repair all apparatus used therefor, including the fire alarm telegraph and telephone system, shall divide the city into fire districts and establish a fire patrol, and shall appoint a chief engineer or engineers and other firemen. He shall also have and exercise all the powers and duties conferred upon him by statute and the ordinances of the city.”

The details of the personnel of the Fire Department are indicated by the accompanying organization chart.

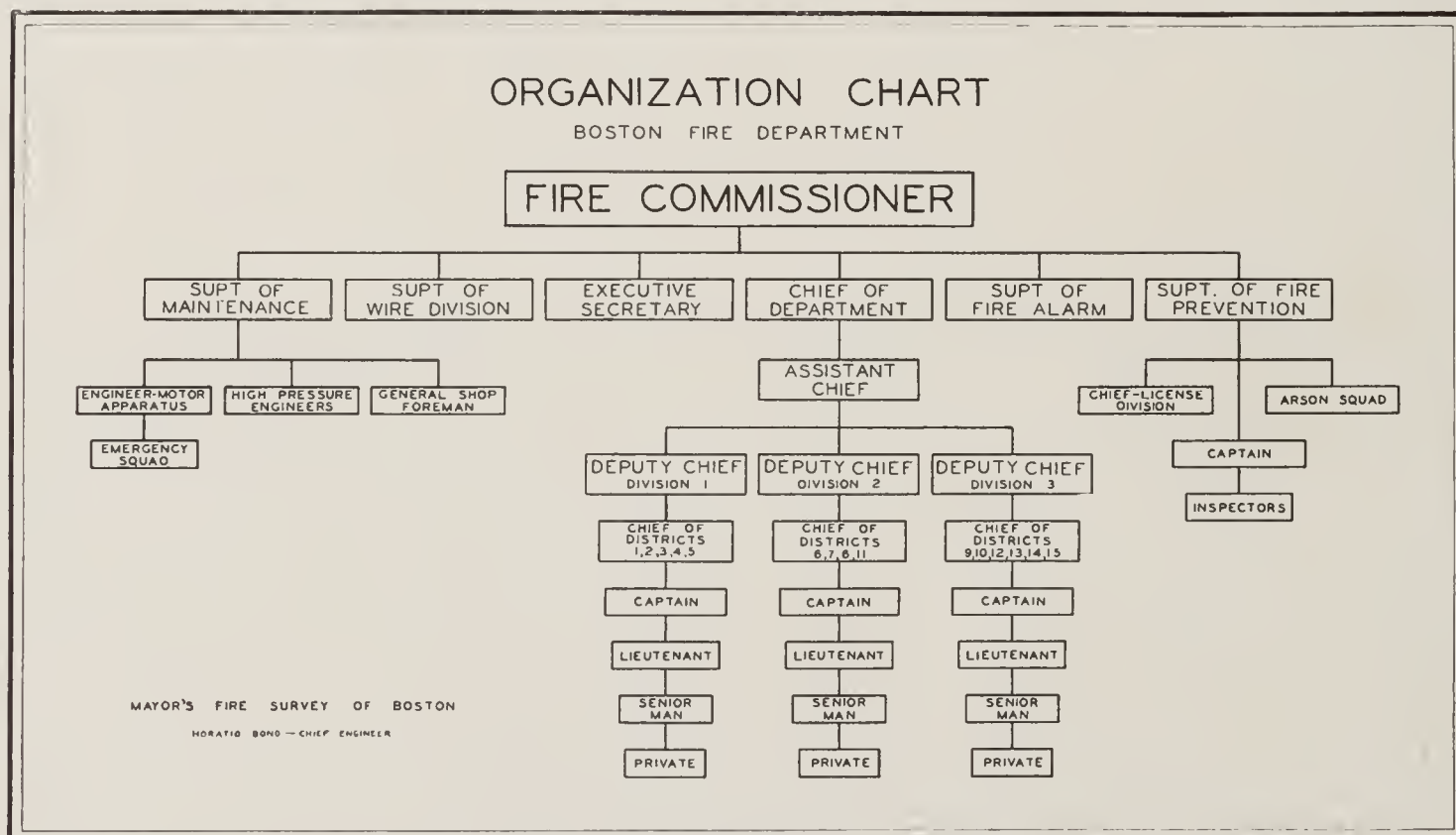


FIGURE 128.

The above definition of the duties of the Fire Commissioner indicates very clearly that he has supreme authority and responsibility in all matters pertaining to the operation of the Fire Department.

The Fire Commissioner, under the present laws, is appointed by and holds office at the pleasure of the Mayor, the appointment being subject only to approval by the State Department of Civil Service. The following is a list of the Commissioners who have held office during the last fifteen years.

COMMISSIONER	Tenure of Office	Approximate Length of Service
¹ John H. Dunn.....	January 27, 1912 to February 11, 1912.....	2 Weeks
Charles H. Cole.....	February 12, 1912 to March 7, 1914.....	2 Years
¹ John M. Minton.....	March 7, 1914 to March 10, 1914.....	3 Days
John Grady.....	March 11, 1914 to February 17, 1919.....	5 Years
John R. Murphy.....	February 17, 1919 to November 1, 1921.....	2½ Years
¹ Joseph Manning.....	November 1, 1921 to April 1, 1922.....	5 Months
¹ William J. Casey.....	April 1, 1922 to August 24, 1922.....	5 Months
Theodore A. Glynn.....	August 24, 1922 to January 26, 1926.....	3½ Years
¹ Thomas F. Sullivan.....	January 26, 1926 to July 7, 1926.....	6 Months
Eugene C. Hultman.....	July 7, 1926 to date.....	

¹ Indicates Acting Commissioner.

The frequent changes in the office of Fire Commissioner, as well as the insecurity of tenure of office have prevented the development of fixed policies of administration and permitted political interference. This has at times inevitably impaired the efficiency of the department. Frequent change in commissioners is manifestly undesirable, as is political interference with appointments, promotions, letting of contracts, and other administrative matters. No well-organized business would consider a new executive every few years. As a matter of policy, the direction of such an important department should be continuous, and this cannot be obtained if the commissioner is changed with every administration.

Even when unmolested politically, commissioners have not always been qualified to administer such a highly technical business as that of controlling fires. The present commissioner is admirably qualified by training and experience for this work. His administration has improved the efficiency of the Fire Department and has been a substantial factor in lowering the city's fire loss.

The Fire Fighting Force. The amount of apparatus and equipment is generally adequate for covering the city and is not considered in detail in this

report,¹ although a list of fire apparatus is given in Table 130. The problem of distribution of fire companies, however, warrants a thorough study. It is recommended that an investigation be made of the possibilities of consolidation and relocation of companies to the end that available men and apparatus may be used to the best advantage, and so that if found desirable to add men or apparatus they may be placed most effectively.

TABLE 130
LIST OF FIRE APPARATUS IN BOSTON
February, 1929

Pumpers:	In Service	In Reserve
1,000 gallon	6	—
750 gallon	44	8
Steamers	—	3
Hose Wagons	47	9
Ladders:		
Aerial	20	3
City service	12	3
Fireboats	3	—
Water Towers	3	1
Rescue Wagons	2	—
Lighting Plants	2	—

AGE AND QUALIFICATIONS OF THE PERSONNEL OF THE DEPARTMENT

Civil Service. General Laws, Chapter 31, as amended, Section 4, states that "no rule shall prescribe a maximum age limit for applicants for positions in police or fire departments lower than 35 years." Applicants for the rank of lieutenant must also have served at least 6 years as a private. The Civil Service rule pertaining to the Police Department, regarding eligibility for promotion to all grades of service other than the lowest, has been interpreted as also applying to the Fire Department and is to the effect that "the examination and appointment shall be limited to persons of the next lower rank; but if the number of applicants for examination in such lower rank is not sufficient to hold an examination, the next lower ranks shall in succession be thrown open to the examination until at least the necessary number have applied."

These three factors have resulted in the age of the privates, as well as all officers in the Fire Department, being unusually high.

Age of Men in the Department. Table 132 has been prepared from data obtained from a questionnaire filled out by all members of the department in February, 1928. Figs. 131 and 133 are diagrammatical presentations of the same data.

¹ A description of the fire apparatus and its distribution in the City of Boston appears in Report No. 158 of the National Board of Fire Underwriters, issued October, 1925.

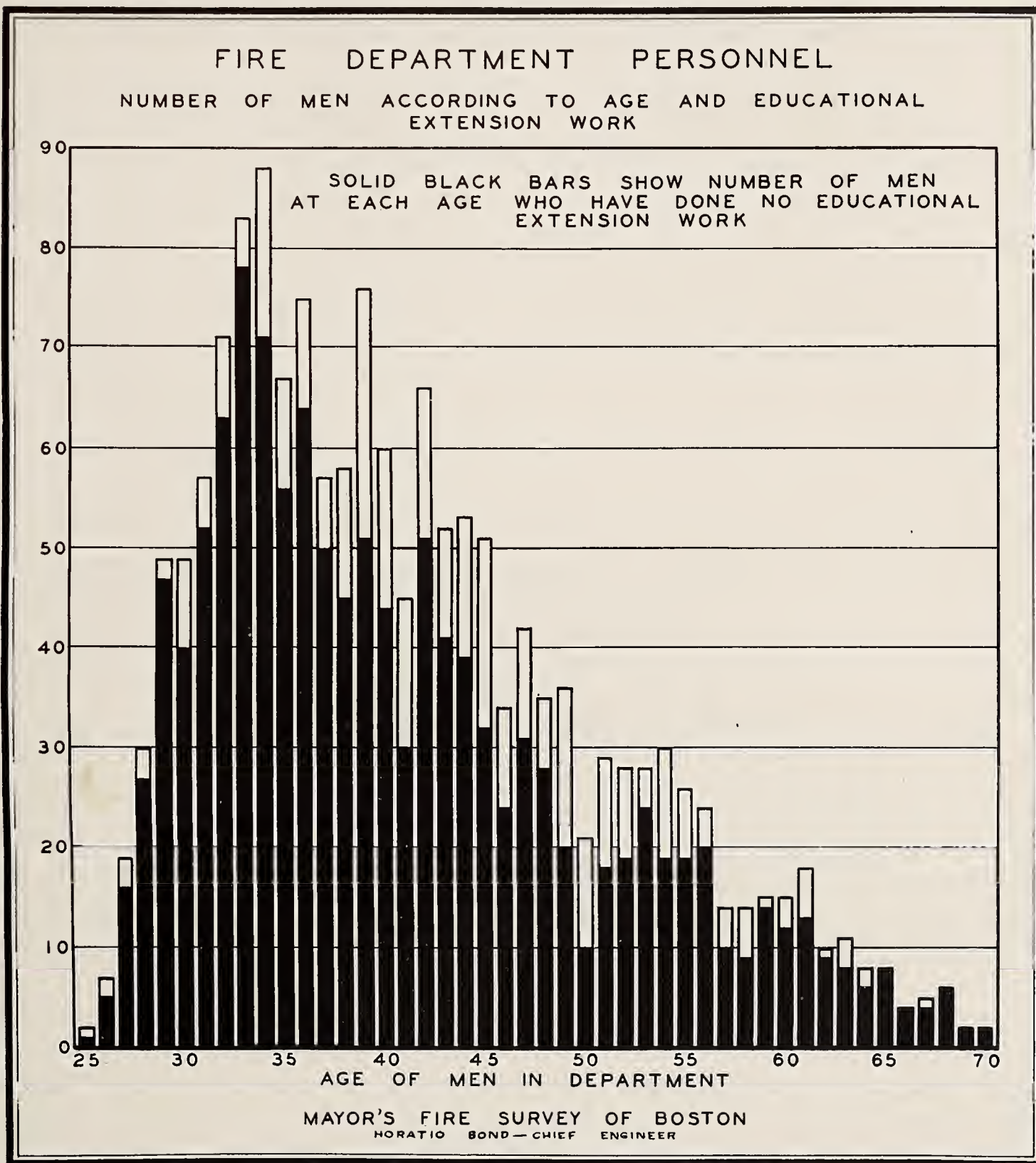


FIGURE 131.

The average age of the whole department is 45 years. This is too high.

It is obvious that the Civil Service law which allows men up to 35 years of age to apply for membership in the department is partially responsible for the high average age of the privates. This high average age existing in the lowest rank naturally increases through the other grades. Lieutenants, the "junior" officers of the department, average about 50 years. There is little justification

for such a high age for the lowest ranking officer. At the present range of ages the deputy chiefs average practically 60 years.

The age limit for entrance to the Fire Department should be lowered to at least 25 years.¹ The educational and possibly the physical requirements should be increased. It should not be necessary as it undoubtedly now is, for a private to serve 6 years before he is eligible or qualified for a lieutenant's rank.

TABLE 132
FIRE DEPARTMENT PERSONNEL DATA
Compiled from a Questionnaire Issued by the Commissioner, February, 1928

RANK	Number of Men	Per Cent. of Total Enrollment	Average Age in Years	EDUCATIONAL EXTENSION WORK			EDUCATION UPON ENTRANCE TO DEPARTMENT			
				NUMBER OF MEN HAVING DONE:			NUMBER OF MEN HAVING:			
				None	Minor	Considerable	Grammar School or Less ⁴	1 or 2 years of High School	High School Graduate or Better	College
Privates ²	1,364	86.0	40	1,133	178	53	926	266	170	2
Lieutenants.....	108	6.6	49	49	56	3	86	17	4	1
Captains.....	73	4.4	54	36	34	3	56	11	6	0
District Chiefs ³	33	2.6	57	22	8	3	23	4	6	0
Deputy Chiefs.....	7	0.4	58	4	2	1	7	0	0	0
Entire Department..	1,585	100%	45	1,244 or 78.5%	278 or 17.5%	63 or 4%	1,098 or 69.1%	298 or 18.8%	186 or 11.8%	3 or 0.3%

Educational Qualifications of the Personnel. Table 132 contains a tabulation of the members' educational status at entrance to the department and a summary of any educational activities pursued since entering. "Minor Educational Extension Work," as indicated in this table, includes "fire college" lectures, or a night school course in English or correspondence, or similar single courses. "Considerable Educational Extension Work" includes two or more comprehensive technical courses such as electrical or automotive courses, as well as courses at Lowell Institute, Wentworth Institute, law or business schools.

¹ This might be extended to 35 in case the applicant had considerable fire department experience or technical education.

² Includes all members of the department other than officers.

³ Includes superintendents.

⁴ Many men of the department have had less than a grammar school education.

The table shows that practically 70 per cent. of the entire department had only a grammar school education or less at the time of entrance to the department. Since entering the department nearly 80 per cent. of these men have made no further educational advance, and only 4 per cent. have done any considerable amount of study. The captains and lieutenants show the largest percentage doing minor educational work. Three district chiefs, or about one tenth of

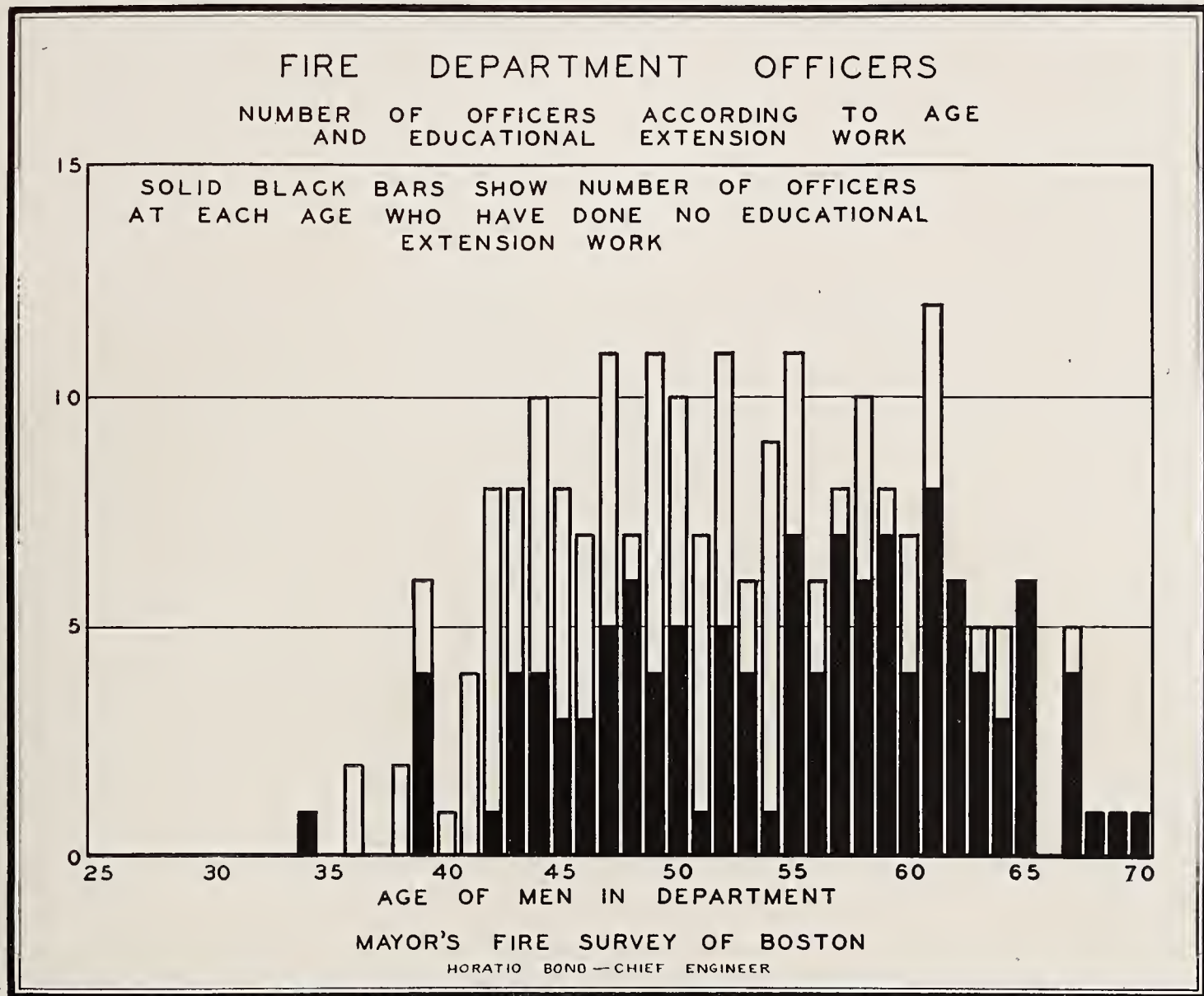


FIGURE 133.

those in the rank, have sought to materially improve their educational status, while 65 per cent. have done nothing of account in training themselves since entering the department. Only one deputy chief out of seven has pursued any considerable amount of outside study. Between the ages of 25 and 34 years, very little extension work is done by those in the department.

The future of any well-organized business depends to a great extent on the caliber of the younger men in the organization, and this applies to the technical business of extinguishing fires and preventing them. It is from the ranks of the

privates that the future officers must be selected. It is essential that in the examining of applicants general intelligence and mental alertness, as well as basic education be given credit in the final grading. A change should be made in the type of examination given to the applicants for the Fire Department so that they shall be examined for general knowledge including some rudimentary engineering subjects, and in addition that some of the more modern intelligence test questions be included which would give an idea of the applicant's general intelligence, regardless of his education. Much of a fireman's duty is specialized and requires systematic training after entering the department. Regardless of his former education, the likelihood of promotion in the department should depend on his ability to assimilate knowledge and to analyze situations that may arise. These latent qualities in an applicant cannot be discovered by "general knowledge" questions alone.

Table 135, prepared from statistics furnished through the courtesy of the Department of Civil Service, shows the number of applicants examined for the Boston Fire Department, and the number eligible for the various ranks as a result of these examinations for the last six-year period. The total number of men eligible for filling the various ranks, runs from more than twice the number necessary to fill the ranks of the privates to at least ten times those necessary for the higher offices. The table also indicates that the examinations have been made more difficult, in recent years, for the ranks of lieutenants, captain, and district chief. This is a step in the right direction. The examinations for entrance and also for deputy chief apparently have varied but little in caliber for the last six years. At least the same percentage, roughly, have been eligible from year to year. Judging from the number eligible, all examinations could be made more difficult and still furnish a sufficient number of men to fill the existing vacancies.

It is recommended that the Civil Service Department cooperating with the Fire Commissioner provide a new type of examination both for entrance and promotion.

The present entrance qualifications have a direct bearing on the rule that requires a private to serve 6 years in the department before being eligible to the rank of lieutenant. If for the average private at least 6 years is the minimum experience necessary to make a good lieutenant, there are reasons why such a long period of "apprenticeship" is necessary. The entrance examinations, both physical and mental, are too easy, so that many men admitted do not have the ability to handle a lieutenant's job. A more concentrated and systematic training of privates is also needed.

Modern industrial or commercial organizations have come to realize that the burden is placed upon them for the training of their employees. Every business today is specialized, and regardless of a man's previous training and education

TABLE 135
CIVIL SERVICE EXAMINATIONS, BOSTON FIRE DEPARTMENT
SIX YEAR PERIOD, 1923-1928
Data Furnished by Department of Civil Service

EXAMINATION FOR	Number Examined	Number Found Eligible	Per Cent. Found Eligible
Entrance:			
1923.....	294	110	37
1923.....	204	104	51
1924.....	602	183	30
1925.....	311	99	32
1926.....	233	84	36
1927.....	257	113	44
1928.....	335	135	40
Lieutenant:			
1923.....	362	359	99
1925.....	413	280	68
1927.....	343	182	53
Captain:			
1923.....	75	75	100
1925.....	84	74	88
1927.....	72	65	90
1928.....	47	40	85
District Chief:			
1923.....	45	43	96
1925.....	50	37	74
1927.....	34	29	85
1928.....	22	13	59
Deputy Chief:			
1923.....	11	11	100
1925.....	18	14	78
1927.....	11	11	100

he has still to assimilate the details of the particular profession selected as his field of endeavor. This "training" of the personnel in the industrial or commercial field is done chiefly on "company time," for it is realized that only a selected few are ambitious enough to pursue such training exclusively on their own time, and also that much of the subject matter can only be acquired through personal contact with those already trained in the particular profession.

It is logical, therefore, to expect the Fire Department to assume the responsibility for training its members, to the end that those qualified may advance as in any other organization. If none are qualified to conduct such training, steps should be immediately taken to acquire a technical staff which should assume, as part of its duties, the direction of this training of the privates and officers of the department. The present training is discussed in a later part of this chapter. Suffice it to say here that very little is done to attract ambitious young men to the Boston Fire Department.

Physical Requirements. The physical requirements for entrance to and promotion in the Fire Department are, by authority of the state civil service law, prescribed by ordinance of the City Council. There are no physical requirements for promotion, but for admission to the department an applicant must be 5 feet 5 inches tall and not obviously physically unfit. The height provision is contained in a section of the special acts relating to Boston, while a fire department medical examination weeds out the others. It is recommended that the present requirements be changed to conform to those employed in the United States Army.

A series of physical examinations should be worked out to vary according to the rank of applicants. Those for the privates, lieutenants, and captains should be nearly uniform, as the physical activities of these men are similar. The physical requirements for district chiefs should be less stringent than for the lower ranks, but should be more exacting than for deputy chiefs and the chief of department. The applicants for the various ranks should be required to pass such physical examinations, before qualifying. As in the army, all existing and future officers should be subject to periodic physical examinations to determine their fitness to hold their respective positions. If not physically capable, they should be pensioned.

Retirement Provisions. The problems of retirement are closely related to the questions of age.

It is recommended that new retirement provisions and pensions for the department personnel to include the following items be provided:

1. An enlistment period for all privates at the end of which they must be reappointed, and an age limit, at which, if not qualified for promotion, the privates should be pensioned.

2. Age retirement provisions for all officers to vary in maximum limit according to rank, with the age limit of the chief to be 62 years, and the lower officers graded in age retirement limits accordingly.

PRESENT DRILLS AND TRAINING

The Assistant Chief of the Department conducts drills at each company house. This has had good results, for not only does the assistant chief obtain information as to the general work of each company, but it also provides a check on the condition of all apparatus. This method inaugurated by the present commissioner has developed company and department morale by leading to a realization that the individual cooperation of every man is required to produce an efficient department.

Attendance at the Telegraph and Pump Schools is optional. Instruction at the former is given by professional telegraphers, and the latter is under the direction of the Superintendent of Maintenance, who is a capable engineer of long experience. Enrollment in these optional courses has increased since the practice was established of including questions in the civil service examinations on the subjects taken up in these courses. Attendance at the Chauffeurs' School is compulsory for all members of the department. Drill School instruction is compulsory for all probationers, and includes instruction in the use of tools and apparatus, ladder-scaling and other rudimentary fire operations.

Lectures are given by the deputy chiefs once a week during the winter months at the various company houses on the more advanced problems of fire methods. In addition to the company drills conducted by the assistant chief, the company officers hold drills at their respective houses on such matters as location of hydrants and fire alarm boxes and the uses of the various tools and equipment.

Every member of the Fire Department has been through the Drill School at least once, and the course is required of all new men. The auxiliary schools are good and take care of the particular training needed for pump operators, telegraphers and chauffeurs.

The training facilities of the department, while greatly improved in the last few years, are however still inadequate. The company drills should be supplemented by regular drill school sessions where men are given uniform training, and where they are taught the duties, not only of enginemen or laddermen, as the case may be, but all the duties that any firemen might ever have to perform. This enables men to be shifted from one type of work to another, both for the purpose of broadening their general experience, and to make it possible to use every man in an emergency for whatever duties are most urgent.

To accomplish this a drill school must be operated continuously, under the direction of a competent drillmaster. This should not take the place of the com-

pany drills and inspections now held which are very valuable in producing company efficiency and morale. The Drill School should make the man proficient in his individual duties; the company drills will ensure that he can work properly with the other members of the company to which he is regularly assigned.

The fundamental idea of the old "fire college" was a good one. It was aimed to provide officers with the technical knowledge necessary to their work. This "college" consisted of a course of lectures by the higher officers of the department, including the heads of the functional divisions, such as Fire Prevention and Fire Alarm.



A floodlighting plant developed by the Fire Department which is used at serious fires. It has greatly facilitated night fire operations and does much to reduce injuries to firemen.

The principal weakness of the "fire college" was a lack of instructors in technical subjects and the difficulties of "mass instruction." Except for the heads of some of the functional divisions, none of the higher officers of the department are technically trained.

There should be in the department a technical staff made up of men with an engineering education or training, who can give this kind of instruction to the younger officers of the department, and who can also direct the performance of other functions in connection with the investigation of fires and inspection work.

The need of technical men for the two latter purposes is discussed in detail in subsequent chapters of this report.

Fire department officers should obviously be instructed so that matters such as building construction, the behavior in fire of explosives and flammables, heat and draft phenomena, the chemistry of fire, etc., may be matters of common knowledge to them. A fire officer must be able to distinguish between those types of building construction which will stand up well against fire attack and those that are easily weakened or may readily collapse. He should, also, for example, know how to handle fires in flammable liquids, pyroxylin plastics, and other chemicals and explosives or fibrous or dusty materials subject to flash fires or explosions.

The "fire college," should therefore be reestablished, technical men provided as instructors and regular and continuous courses be given. An additional advantage of the facilities for such instruction will be the chance afforded officers to compare notes on fire experiences so that lessons learned from fighting fires in the past may be applied to the fighting of fires in the future. The better qualified superior officers of the department should of course supplement the work of the technical staff so far as fire fighting methods are concerned. Classes should be kept small to promote individual effort.

FIRE DEPARTMENT OPERATION

The general operation of the Department has been greatly improved in the last few years. Some of the outstanding improvements, which have contributed to lower fire losses throughout the city, are discussed following.

Response of the District Chiefs. A study of fire alarm records in 1926 revealed the fact that the district chiefs were lax, in many cases, in responding to alarms. It was common to find fires at which this officer had not reported in 12 to 15 minutes or more, in fact, there were individual cases where over 20 minutes elapsed between the alarm and the time of his reporting. In order to impress upon the district chiefs the importance of their early arrival at a fire a general order was issued in the latter part of 1926 that the first duty of the chief's driver upon arrival at a fire was to "tap in" at the box, announcing his arrival to fire alarm headquarters. This time of arrival was then checked against the time of the original alarm, and daily records of both sent to the Fire Commissioner.

This plan has worked improvement in the responses of these officers. The records of 1929 show arrival at fires regularly in 4 or 5 minutes or less and 8 minute intervals were rare. Their prompt response is important because they must be on hand to direct operations of the men and apparatus already on the spot and to act in emergency cases where the need of a second alarm is imperative.

Speeding up of Second Alarms. Another improvement in general fire methods has been the speeding up of second alarms. It was apparently considered an admission of defeat to quickly "pull a second," and district chiefs were reluctant to do so. Under definite orders to sound a second alarm whenever there is any appearance of necessity for it, apparatus is now more quickly mobilized, making adequate man-power available whenever there is even a slight chance that it may be needed. The times when such mobilization has been vital warrants the general procedure and the inference that it has been a factor in reducing the large number of "big" fires representative of former years. (See Chapter 4.)

New Running Card. A new "running card," recently put into effect, is further improving the mobilization of men and apparatus at fires. For example, on second alarms, third-alarm apparatus moves into approximately the quarters vacated by the first-alarm apparatus so that if a third alarm is necessary, the apparatus has only a short run to make. This does not shorten the actual runs the apparatus has to make but means shorter runs when responding to the fire itself. Some fairly long runs are made necessary under the new plan to insure that at all times every district has at least one engine and one ladder to respond directly to an alarm for a second fire. It also better distributes the relative amount of work performed by each company, using outlying companies more than under the old plan.

Roughly speaking, the new running card provides for one or two more companies on second alarms than formerly, and heavier response on third alarms. As much apparatus and men are now sent on five alarms as were formerly sent on six.

The practice has been established of sending "box" alarm apparatus on "still" alarms at night. Ordinarily on still alarms only one engine company and one ladder company is sent to the fire. The heavier response should help to reduce the losses from serious fires, most of which have been occurring at night. (See Fig. 89, Chapter 4.)

Special Equipment. Special equipment has recently been furnished which has improved the efficiency of the fire-fighting force and added to the safety of the men.

The lack of adequate lighting at night fires in the past has hampered the work of the firemen. A portable lighting plant supplying electric current to a series of flood lights was constructed in the department shop and has performed excellent service. In addition, individual electric lights have been provided which the firemen wear on their caps, similar to those used by miners. Injuries at night were of more frequent occurrence before the introduction of these devices.

Prompt ventilation of buildings is always of vital importance. A smoke extractor has been designed and built by the department which has performed valuable service at fires in removing heavy smoke from basements and other confined spaces.

Protection for the city's waterfront has been materially improved. Radio equipment has been installed on the fireboats and inter-communication is now possible between the fire alarm office and the fire boats at all times. Boston is the only city where such inter-communication is yet established. One important result of this improvement has been the prevention of traffic blockades formerly caused by the necessary opening of the numerous draw-bridges over the Fort Point Channel. On waterfront fires in the South Bay, a fireboat is assigned to



One of the auxiliary or "pup" fire boats which have proven very effective at waterfront fires by reason of the ease with which they can reach parts of wharf structures inaccessible to the large fire boats or the land fire forces.

the fire and starts up the channel as the alarm is received. On his arrival at the fire, the district chief, if he finds the boat is not needed, can now so inform fire alarm headquarters which radios the fireboat to return to quarters. In the past year alone this is reported to have saved 236 unnecessary operations of these draw-bridges. At the time of the \$200,000 Boston Floating Hospital fire, one of the badly needed fireboats was on its way to an insignificant fire on an island in the harbor. With the radio it was possible to recall the boat without delay.

A "pup" fire boat is now carried on each large fire boat. This new equipment is a small boat, driven by an out-board gasoline motor, and is capable of furnishing one effective hose stream of small caliber. Formerly, in case of a fire under a pier, it was necessary to cut holes in the flooring to get at the fire, a slow and cumbersome method. The "pup" fire boats furnish not only effective means for getting at a fire under an otherwise inaccessible pier, but also leave the larger boats free to furnish large hose streams as may be needed.

Fire Methods. From observation at actual fires, there appears to be need of better supervision of certain operations. Thorough overhauling after a fire is "knocked down" is necessary to prevent rekindling. With intelligent direction these operations can be performed with a minimum amount of damage. The commanding officers are charged with the supervision of all overhauling, and no work of this nature should be done except under their direction. It is evident that there should also be a closer supervision of all ventilating work, in which personal judgment is a great factor. One of the important results that would follow regular and intensive drill work would be better discipline which would heighten the officers' effectiveness in these operations.

The use of small hose lines in overhauling has been recently inaugurated. When a fire is judged by the commanding officers to be completely under control, there should be a more general use of small lines or at least of the reducing tips provided for the big nozzles. There seems to be unwarranted reluctance on the part of the department to use this equipment.

Maintenance Division. This division is in charge of a well qualified superintendent and is well conducted. The operation of the department is, by necessity, on an emergency basis. The force must be of sufficient size to turn out rush work in case several pieces of apparatus are out of commission at one time.

Careful checking of all company apparatus by both company officers and the maintenance department inspectors is carried on and all new apparatus which is purchased is given an acceptance test by this division.

The present shops are not particularly adaptable to large motorized apparatus, and the assembling under one roof in enlarged quarters, of the present fire alarm repair shop, the department garage (now on Wareham Street), and the present maintenance division should be considered.

Salvaging Operations. As described in Chapter 9, the Boston Protective Department, operated by the insurance companies, performs the salvage work at time of fire, and to date the Fire Department has consequently not considered such protective work as part of its duties. The first duty of a fire department is to save life, and the second is to protect property in case of fire. It is logical, and in direct line with their duty, therefore, that the Fire Department at least assist in salvage operations in order to keep losses incident to all fires at the mini-

mum. Such operations in brief include the covering of stock to protect it against water damage, removing excess water from buildings as soon as possible, restoration of sprinkler protection, general cleaning up, and any incidental operations which will protect the contents from unnecessary damage during or after a fire.

Under the present set-up, the Boston Protective Department, being the only agency performing salvage work, is required to spread its activities over the whole city, with the result that many unnecessary runs are made to outlying districts which at times may leave the city proper, where high values are concentrated, without maximum protection. The Protective Department has adequate facilities to cover the congested district at present, but to cover the rest of the city efficiently must have the active cooperation of the Fire Department. If salvage work were recognized as a definite fire department function the efficiency of operation over the whole city could be materially improved, and losses be correspondingly reduced through closer cooperation between the two fire control organizations.

This would necessitate the Fire Department being trained in salvage operations as a regular part of its drill school work. A course of instruction in salvage operation could be developed in cooperation with the officers of the Boston Protective Department.

The low value but large area sections of East Boston, Hyde Park, Brighton, West Roxbury and Dorchester are the districts where the cooperation of the Fire Department is most needed for efficiency. If the ladder companies in these territories were provided with salvage equipment, and the men trained in salvage operations at the drill school, this type of work could be done by the Fire Department in all but the few high valued minor mercantile centers in these districts. The Protective Department would then respond only to predetermined boxes in these high value sections, the salvage work in the remainder of the territory being performed by the Fire Department. Whenever the Fire Department on arrival in districts not covered by the protective companies finds that equipment additional to that carried on their ladder trucks is needed, it could start laying covers and the Protective Department then be called to furnish any additional equipment deemed necessary.

Training the Fire Department in the fundamentals of salvage work would enable it to assist the Protective Department at all fires whenever other duties permitted. Working hand in hand, these two departments could accomplish much in the way of reducing losses which is the ultimate aim of both organizations.

A TECHNICAL DIVISION FOR THE DEPARTMENT

There should be a technical division for the department. It should have as head a capable superintendent. He should have an engineering education and

technical training, preferably in fire protection engineering. He should have at least 5 junior engineers as a staff.

The duties of this division would be to carry on such research and study as might be necessary (this report suggests many lines of study that such a division could profitably develop) and make recommendations to the Commissioner to enable him to plan properly the administration and operation of the department. In this respect the work of this division would be purely advisory and while its activities in research and planning alone would be of great value in increasing the effective operation of the department it would have other important functions.

One of these would be to plan and supervise such courses as should be given in the proposed officer's school or "fire college," providing instructors in technical matters. Another would be to provide a personnel competent to investigate the technical aspects of fires, and make dependable reports thereon. The importance of this work has been indicated in Chapter 11, "Investigation of Fires." An equally important function would be to provide inspectors qualified to pass on the protection of special fire hazards resulting from hazardous manufacturing processes or from the storage of hazardous materials. In this the technical staff would strengthen the work of the inspectors of the fire prevention division, and give the regular inspectors such training as is necessary. This particular function is discussed in further detail in Chapter 12, "Fire Prevention Inspections."

The improvement of methods of fire department operation in fire fighting and fire prevention work has been retarded, not only in Boston but in all the cities of the country by the lack of adequate technical knowledge applied to these problems. The present conditions of service and slowness of promotions do not attract to the department men of engineering education. Accordingly, such talent must be introduced into the Fire Department. The personnel of the technical division should be appointed by the Commissioner, subject to approval and tenure of office under the provisions of the civil service laws. Its members need not qualify in all respects as other members of the department, but the civil service department should determine whether or not they are qualified to do their work. The superintendent of the division should be qualified both by training and experience. Experience is less essential in the subordinates, but all should have a technical or engineering education. Men educated in civil, mechanical, electrical or other branches of engineering, or chemistry or physics, should qualify if the training fits them to perform the particular duties which are assigned to them. Plenty of men are available to fill such positions at salaries no greater than those paid to captains or lieutenants in the uniformed force.

CONCLUSIONS AND RECOMMENDATIONS

The better work of the Fire Department seems to have been the principal cause of lower loss records in 1927 and 1928. The department in all its branches

deserves credit. Morale and efficiency have improved, and the work of the maintenance, fire alarm, fire prevention and other divisions has been made more effective. Improvements in fire fighting facilities have also contributed to the result. The department has the chance of becoming one of the finest in the country if the restrictions which are now placed on its development are removed, and its major deficiencies are corrected.

Fire Commissioner. It is recommended:

1. That the fire commissioner should first be a capable and qualified person, preferably an engineer.
2. That he should be allowed to administer his office without political interference.
3. That the administration of the department should, as a matter of policy, be continuous.

Fire Fighting Force. Age requirements should be such as to make possible the rapid advancement of capable men. With this in mind the following recommendations are made:

1. That the maximum age limit for admission to the department be reduced to 25 years.
2. That a thorough study be made of the examinations for admission, both physical and mental. The mental examinations should include some elementary engineering subjects, as well as some questions that will indicate the applicant's general intelligence regardless of his education.
3. That a similar study be made of examinations for promotion, both physical and mental. The physical examinations should be varied in degree of severity according to the rank to be filled by such an examination.
4. That men be admitted to the department for a definite period of enlistment, at the end of which they may be retired regardless of age or physical condition if fitness for fire department service has not been demonstrated.
5. That a study be made to determine a proper age limit for compulsory retirement of men in each rank.

Technical Division. It is recommended:

1. That the lack of men with technical or engineering education be taken care of by the establishment in the department of a technical division, headed by an experienced and technically trained fire protection engineer, with a staff of at least five junior engineers.
2. That the technical division, when created, continuously study the records of fire alarms, the development of building and the introduction of new fire hazards in various parts of the city to

the end that fire stations, apparatus and men at all times may be provided to properly protect the city. This will mean research into the location of stations, amount and kind of apparatus provided, and the number of men required to properly handle the apparatus, and any other factors affecting the employment of men or equipment in fighting fires.

Fire Methods. It is recommended:

1. That an officers' school or "fire college" be established. The proposed technical division of the department should plan the general courses given at this school so far as they relate to technical subjects with which the officers should be familiar. For instruction in fire fighting procedure the more experienced and successful chief officers of the department should be assigned to the school. They should lead discussions regarding the handling of typical fires, and instruct the junior officers in matters of general procedure at fires. This sort of instruction should make it possible for junior officers to develop more rapidly than if dependent solely on the lessons derived from their own fire experience.

2. That a drill school for the regular and continuous instruction of all men in the department be established. This should be in addition to the training of probationers, and in addition to company drills or inspections. Its purpose is to keep the men in physical condition, and thoroughly versed in all duties which any private may be expected to perform. Its greatest value will be improvement of discipline.

Salvaging Operations. It is recommended:

1. That instruction in salvage operations be included in the Fire Department Drill School.

2. That salvage equipment (covers and tools) be carried by ladder companies in East Boston, Hyde Park, Brighton, West Roxbury and Dorchester, and that the Fire Department perform salvage work in those districts of the city to which regular response of the protective companies is not practicable.

3. That the firemen assist the Protective Department in removing water from floors, cleaning up, and other salvage operations when other duties permit.

Maintenance Division. It is recommended that in the interests of efficiency the present maintenance shop, the Wareham Street garage, and the fire alarm repair department be consolidated.

CHAPTER 8

FIRE DEPARTMENT MUTUAL AID IN CITIES OF GREATER BOSTON

As a study of the fire protection facilities of Boston should logically include consideration of the fire protection and fire loss situation of the cities and towns comprising the Greater Boston area an investigation was undertaken of such cooperation as now exists among the fire fighting forces of Greater Boston.

As already indicated (Chapter 3, Fig. 61), the fire record of Greater Boston compares unfavorably with the record of other metropolitan areas of like size and population. Detailed tables on the fire losses of 39 cities and towns around Boston are included in Appendix 8.

A study of the fire records of some of these communities discloses that the bad records have usually been due to serious large fires in which outside aid was required by the local fire departments.

The experience of the Boston Fire Department has indicated that quicker and heavier response of apparatus to alarms has substantially reduced the number of large loss fires. (Table 66, Chapter 3.) It is therefore reasonable to assume that a comprehensive system of mutual aid among fire departments in the Boston area would undoubtedly promote a like result.

Beside this consideration, there are several areas in and around Boston that offer serious conflagration possibilities. (See Fig. 148.) Large concentrations of fire apparatus would be needed at such points in event of serious fires and considerable areas would be left unprotected at such times unless an adequate mutual aid system existed.

MUTUAL AID IN GENERAL

Mutual aid among cities and towns in Greater Boston is not a new idea. As far back as the Chelsea conflagration in 1908 there was a definite agreement with Boston as to response of Boston companies in event of a serious fire in Chelsea. As early as 1881 a fire alarm box on the Boston system was located in Chelsea and regular response up to a fourth alarm was indicated on the Boston assignment book put into effect January 1, 1907. The same assignment book provided for response to Somerville, Cambridge, Revere, Winthrop, Milton, Quincy and Watertown. Numbers were assigned to these localities and a call from one of them was sent out from fire alarm headquarters the same as a box alarm and companies responded in accordance with the assignment book.

Cambridge and Somerville have for years worked together on "line" boxes (boxes located adjacent to the boundary line between the two cities) and on multiple alarms. Brookline, Newton, Milton and Somerville have also for some years cooperated with Boston on "line" boxes. Such cooperation has not, however, been taken into consideration by the Boston Fire Department in making up its assignment cards.



FIGURE 148.

During the past few years this mutual aid idea has gained considerable favor and more definite and elaborate systems have been, and are being, worked out. Some of these systems are excellent in their idea and method of operation, but drain the resources of their territories on multiple alarms, while additional apparatus would be available without such draining were the system applied to additional territory including Boston. Others seem to operate well but with little or no definite arrangement. Still others seem to be more or less one sided, one community giving much more than it receives.

One of the best-arranged systems in operation at present is that among the cities of Chelsea, Everett, Malden and Revere. This system was developed by the fire chiefs of these four communities. It provides for inter-city response to "line" boxes, response and "covering-in"¹ on multiple alarm fires in each of the cities included in the agreement, and response to alarms in the adjoining cities where two boxes have been pulled and an alarm is received from a third box.

The system also provides for the inclusion of Medford, Winthrop, Somerville and Boston companies on fourth-alarm response, depending, of course, on the location of the box pulled. The arrangements with these four communities, while included on the printed assignment cards of Everett, Chelsea, Revere and Malden, are less definite and aid from these cities must be called by telephone. Plans are now under way for closer cooperation with Medford.

The actual working out of this system has been accomplished by running a fire alarm circuit from each of the interested communities to one or more fire stations in the others. One of the weak points in this system appears to be that it is not adequately tied into Boston. With adequate cooperation from Boston the system could be simplified, additional companies could be made available on multiple alarms, shorter runs could be worked out (with modern traffic conditions this is important) and the territory vacated by responding companies could be better covered.

Another excellent suburban system is the mutual aid agreement between Arlington, Belmont, Lexington, Medford and Somerville. The mechanics and operation of this system are similar to the one just described. Plans are being perfected for the inclusion of Winchester in this mutual aid group and Arlington and Winchester are already working together on "line" boxes. Wires have also been provided as far as the Cambridge line on the Arlington side anticipating a future hook-up with Cambridge. Line boxes are answered by both towns interested, and regular provision is made for response on multiple alarms in the various communities. Belmont in addition to being in this group also has an agreement with Waltham and Watertown providing for mutual assistance on "line" boxes and multiple alarms.

¹ Occupying temporarily stations in territory vacated by responding companies.

For many years Somerville and Cambridge have worked in cooperation, particularly on "line" boxes. All Somerville box alarms are received in Cambridge fire alarm headquarters and line boxes retransmitted over the Cambridge system. On both the Cambridge and Somerville assignment cards response by the "over-the-line" companies is provided for the first alarm only. On multiple alarms the matter of sending companies from one city to the other, either to the fire or for "covering-in," is apparently left to the judgment of the commanding officer of the department.

To the west of Boston, Belmont, Watertown, Waltham and Newton have effective mutual aid arrangements, and Brookline and Newton work together. Brookline formerly answered a number of Boston "line" boxes on the Allston side and also on the Roxbury line. It is understood that this is no longer regularly done and Brookline assistance has been limited to first alarms on a few boxes along Commonwealth Avenue and Beacon Street, and occasional multiple alarms on other "line" boxes. Brookline calls on Boston and Newton for assistance after her own resources are exhausted on multiple alarm fires.

BOSTON AND MUTUAL AID

The present Boston assignment card takes into account the mutual aid factor only in the handling of a "general" alarm. The sounding of a "general" alarm provides for the movement of the maximum amount of apparatus in any given district and leaving in quarters the smallest number of companies essential for safety. In order to accomplish this it has been necessary to provide for the movement of suburban companies into the city and toward the fire. This has been done by utilizing one or two companies each from a number of the adjacent cities and towns.

In addition to this utilization of outlying companies there are a number of mutual aid agreements with adjoining communities covering for the most part first alarm response on "line" boxes. These arrangements, more or less indefinite in some of their features, exist between Boston and the following communities: Somerville, Newton, Brookline and Milton. Chelsea was formerly called upon in the event of multiple alarms in East Boston, but this arrangement has been discontinued although Boston fire alarm tapper¹ circuits still run to two Chelsea fire stations. It is probable in an emergency that Chelsea would respond without waiting for a specific request if assistance were needed in East Boston or Charlestown.

Engine Company 32 of Boston, located near Sullivan Square, has a Somerville tapper. This company responds to seven Somerville boxes located near the

¹ A "tapper" is a signal device operated by a magnetic relay which enables the sounding of the taps which give the number of a fire alarm box which is pulled.

line and in return Engine 1 of Somerville answers two, and Engine 2 answers four boxes in Boston north and west of Sullivan Square. No agreement exists in regard to multiple alarms but Somerville companies have several times voluntarily responded to fires as well as "covered-in." No recognition is made on the Boston assignment book of the response of the Somerville companies, because there is no definite arrangement.

No agreement exists with Cambridge, but the Boston fire alarm office has at least once used a Cambridge company to respond in Brighton when companies in that district were all engaged.

Engine Company 51, located at Oak Square, Brighton, has a Newton tapper. This company responds to six Newton "line" boxes on first alarm. Response to other boxes in this section of Newton might be made in an emergency, but no response to multiple alarms is provided for. A Boston tapper is located in the quarters of Engine 1 of Newton. This company answers five Boston boxes on first alarm and 55 more on second and multiple alarms. This company also will cover these 55 boxes on first alarm in the event that Brighton companies are engaged at a multiple alarm fire elsewhere. This aid is neither indicated nor apparently taken into account in the Boston assignment card.

Dedham companies respond on first alarm to Boston Box 2661 if Dedham Box 521 located on the same pole is pulled. A sign over the boxes instructs the person sending in an alarm to pull both boxes.

A Brookline tapper is located in Boston fire alarm headquarters and in the event of ten blows followed by the box number being received over the Brookline system the nearest Boston companies are dispatched to the fire. Boston tappers are installed in the following Brookline stations: Engines 1, 2, 3, fire alarm headquarters, and chief's office. Engine 3 of Brookline responds to six Boston "line" boxes on first alarm and on multiple alarms from "line" boxes the Brookline Chief and an Engine Company usually respond voluntarily.

In its agreement with Milton, Boston makes the closest approach to real cooperative mutual aid. Engine 16, Ladder 6, on River Street, Engine 19, at Mattapan, and Engine 49, at Readville, each have a Milton tapper. Engine 16 and Ladder 6 respond to five Milton boxes on first alarm and one on second. They also answer three additional boxes on first alarm should there be another alarm in on the Milton system. Engine 19 responds to 15 Milton boxes and Engine 49 to nine on first alarm. Milton relies on this help more or less, but the weak point in the hook-up lies in the fact that should these Boston companies be absent from quarters at another fire their response to Milton boxes would not be covered. Response to multiple alarms is not provided for.

A Boston tapper is located in the station of Engine 1 of Milton. This company responds to nine Boston boxes on first alarm and eight on second. This response is not recognized, however, on the Boston assignment cards for these

boxes. In addition, Milton will cover Engine 16 or Engine 19, when either is out at fires, or other stations on request of the Boston fire alarm office. Hose 4 of Milton will cover 16 boxes in Hyde Park on second alarm or if Engine 49 is out.

A COMPLETE MUTUAL AID SYSTEM FOR GREATER BOSTON

The preceding briefly outlines some of the existing mutual aid arrangements and their operation. Even though lacking in coordination and other features, they demonstrate beyond a doubt their value as part of an organized fire fighting system. An effort should be made to coordinate and extend the mutual aid plan to include *all* the cities in Greater Boston. This would bring about a system of response or of covering on multiple alarms to provide a response of at least four engine companies on second or succeeding alarms and adequate covering of all vacated territory so that in event of a second fire at least a portion of the regular first alarm response would be immediately available. Such a system would work to the advantage of all cities and towns involved, the largest as well as the smallest.

The details of working out the system appear neither intricate nor costly. Extension of fire alarm systems to be inter-communicating would be advisable and practicable for the most part but in some instances telephone communication might be used. Uniform assignment cards should be provided and there should be no confusion as to assignments once these cards were in use. Matters of responsibility for accidents and injuries while fighting fires beyond a political boundary can easily be adjusted by adequate legislation. Authority at a fire would naturally rest on the chief officer in whose territory the fire is located — all officers responding under the mutual aid system to report to him.

The benefit of a systematic mutual aid system is best shown by a graphic analysis of the movements of fire apparatus on multiple alarms. Maps have been prepared for various sections of the territory under consideration representing conditions at a given point after the sounding of a second alarm. For the sake of simplicity only the first and second alarm movements of apparatus have been shown on the map, the assignments for additional alarms being indicated on an accompanying assignment card.

In discussing movements of Boston apparatus the running card in use at the time this study was being made (January, 1929) was followed. A new running card for Boston was at that time being printed, but for purposes of illustrations the "old" card was used. Boston's "new" running card in general provides for heavier response on multiple alarms and more covering-in but the differences between the two systems of response do not invalidate the illustrations of general situations.

In studying the proposed mutual aid plans it is to be remembered that response on multiple alarms in some sections — particularly in some of the outlying cities or towns — would not only be quickened by such cooperation but strengthened and increased. This will be very apparent from even a casual study of the assignment cards on the accompanying diagrams. These assignments cards presented for purposes of illustration indicate only engine and ladder company response. In a few cases hose companies (particularly hose companies 3, 5 and 7 of Somerville), have been considered as engine companies. This has been done for the sake of simplicity for in this chapter the logical arguments for an inter-city mutual aid system are presented rather than any attempt having been made to work out the specific details of such an organization.

No claim is made that the suggested response under a mutual aid system to the boxes shown is the only practicable arrangement of response, or even that it is the best arrangement. It merely shows one way in which apparatus might respond under such a system. In most cases the situations have been discussed informally with the chiefs of the fire departments affected who have agreed to the general idea. If such a scheme is put into effect it must be very carefully planned in every detail which it is obviously neither feasible or necessary to do here.

Brighton, Box 527, Cambridge and Washington Streets. The first situation considered, Figs. 154 and 155, is the response to Boston Box 527, located at Washington and Cambridge Streets, in Brighton. First consider the situation after the first alarm has been received. All companies in Brighton are at the fire except Engine 34 on Western Avenue on the north side of the district. No ladder company of the Boston department is available nearer than Ladder 26 at Longwood Avenue and Brookline Avenue which must cross Brookline to reach Brighton, or Ladder 15 at Boylston and Hereford Streets which would have a long run up Commonwealth Avenue.

Picture then a fire occurring in Brighton while one fire was already in progress requiring both Brighton ladder companies. Assume traffic conditions particularly heavy (not an unusual condition) delaying both Ladder 26 in crossing Beacon Street and Ladder 15 in traveling up Commonwealth Avenue, what would be the situation if lives were endangered in an apartment house well ablaze? As shown in Fig. 155, under a mutual aid agreement Ladder 3 of Newton and Ladder 1 of Brookline would respond, both of which could reach almost any point in the district quicker than could the two Boston companies mentioned. Nor would they leave their own territories seriously uncovered, for the territory of the Newton company could easily be covered by one of the two ladder companies stationed at the Central Fire Station in Watertown and the normal territory of Ladder 1 of Brookline would be covered by Ladder 2 of Brookline and Ladder 26 of Boston — the latter moving up to station of Ladder 1 of Brookline if necessary.

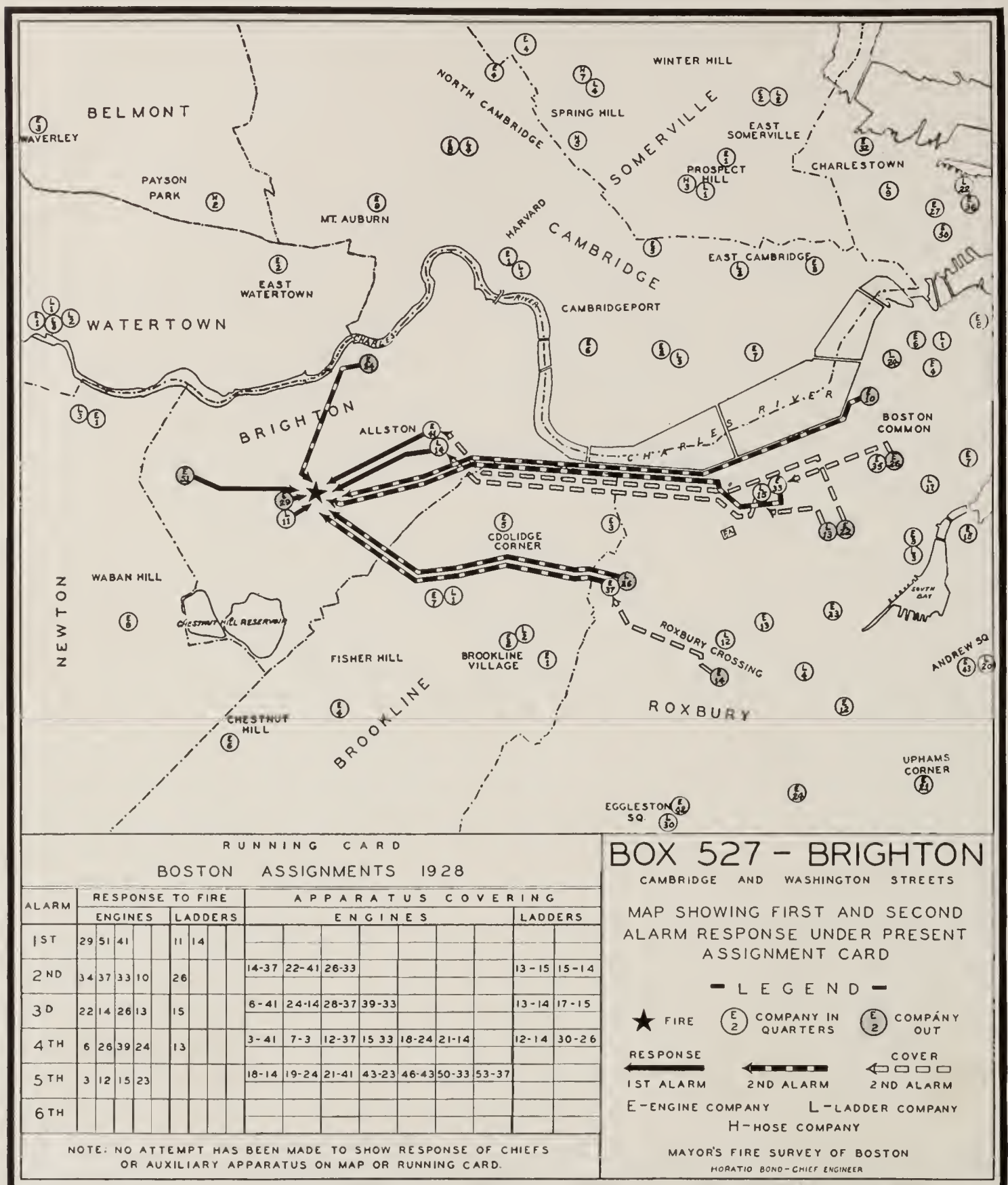


FIGURE 154.

The situation relative to engine companies works out much the same way. With the exception of Engine 34, additional engine companies must come from a considerable distance. Depending on the particular section of the district from which the second call was received it is obvious from Fig. 155 that the companies

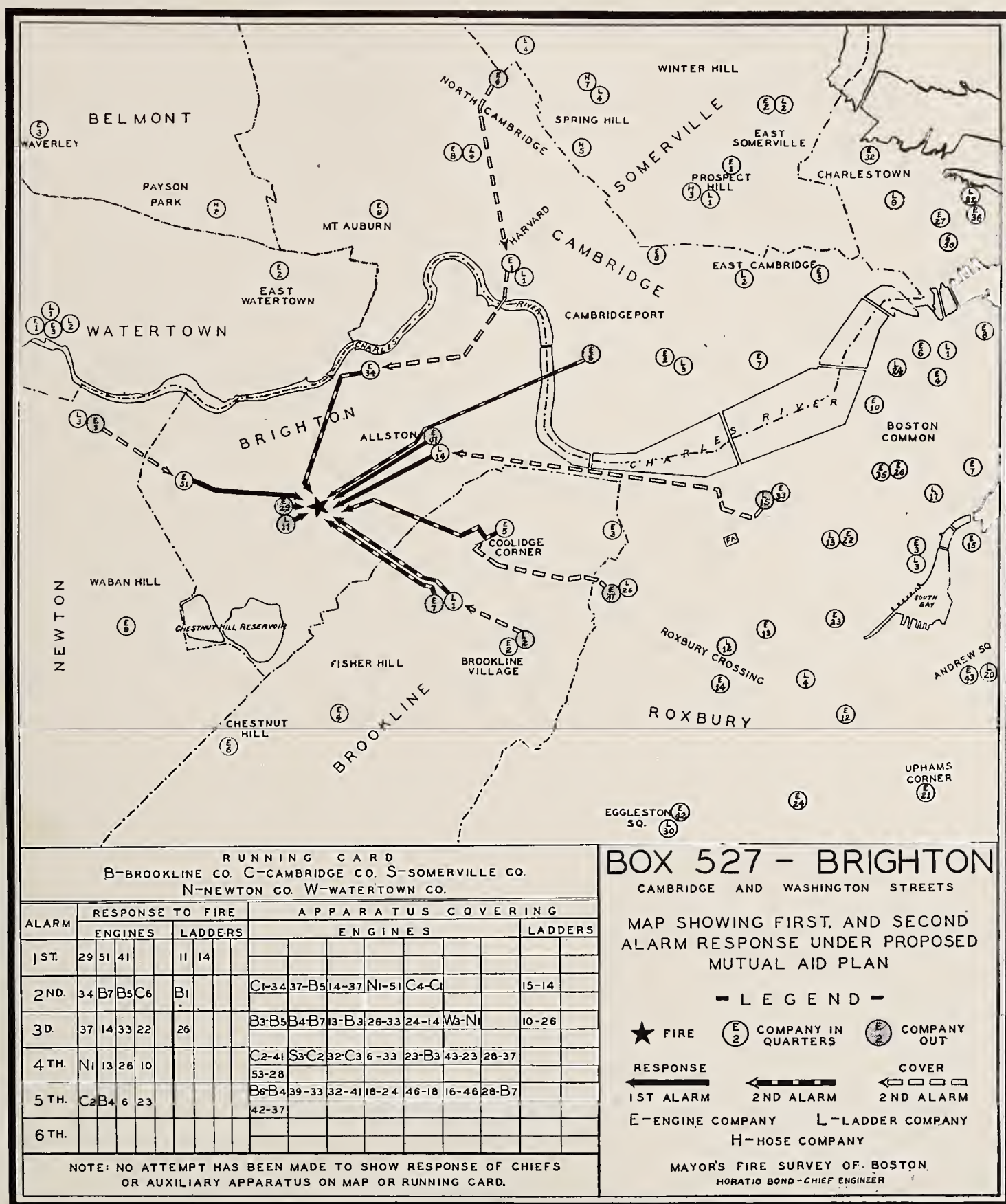


FIGURE 155.

from Newton, Brookline, Cambridge or even Watertown are nearer than the nearest Boston companies. Furthermore they can reach the fire with less interference from traffic on the main highways.

Fig. 154 shows the situation as it exists today after a second alarm has been sounded from Box 527.¹ Engines 29, 41, 51 and Ladders 11 and 14 have responded on first alarm and Engines 34, 37, 33, 10 and Ladder 26 on second alarm. To keep apparatus moving toward the fire and to cover territory vacated by the responding companies Engine 14 moves from Eliot Square to the station of Engine 37 at Longwood Avenue, Engine 22 moves from Warren Avenue to the station of Engine 41 at Allston and Engine 26 from Broadway to the station of Engine 33 at Boylston Street, near Massachusetts Avenue. Ladder 15 moves from Boylston Street to the station of Ladder 14 at Allston and Ladder 13 from Warren Avenue to Ladder 15's vacated quarters. This means the moving of three engine companies (6 pieces of apparatus) and a truck company out Commonwealth Avenue either to the fire or to cover-in. Under conditions of heavy traffic such movement of apparatus is apt to be considerably impeded. In fact, just this has happened more than once.

It will be noted that with the exception of Engine 34 all companies responding on the second alarm must pass one or more Brookline companies located nearer the fire and also so located as to be able to respond with the least delay from traffic. As response to subsequent alarms is considered, the advantage of the utilization of mutual aid companies becomes more marked. Fig. 155 showing the response under the mutual plan, shows quite a different picture from Fig. 154. Without depleting fire apparatus in the areas involved it has been possible to bring about quicker response to the second alarm and encounter a minimum of traffic in reaching the scene of the fire.

Further study of the third, fourth and fifth alarms under the mutual aid plan from the suggested running card of Fig. 155, will show how companies may be brought, not from just one side of the fire, but from all sides, thus making for better distribution of apparatus at the fire and better protection of territory left vacant.

Brookline, Box 26, Coolidge Corner. The second situation studied was an imaginary fire at Brookline, Box 26, located at Coolidge Corner. In this situation it is possible under the mutual aid plan to materially increase the number of companies responding on a second alarm and yet leave the adjacent areas adequately covered. The additional response on the second alarm may well obviate the necessity of additional alarms and standardize the response to correspond to similar locations in Boston.

Fig. 157 showing present assignments shows Brookline practically stripped of companies after a second alarm and dependent upon Engine 37 and Ladder 26 of

¹ It should be noted on Fig. 154 that no recognition has been made of the probable response of Engine 1 of Newton on the multiple alarms to this box. Under the present agreement it seems likely that this company would respond to the fire or cover-in at Engine 51, yet it is not so indicated on the Boston running card and cannot be officially considered.

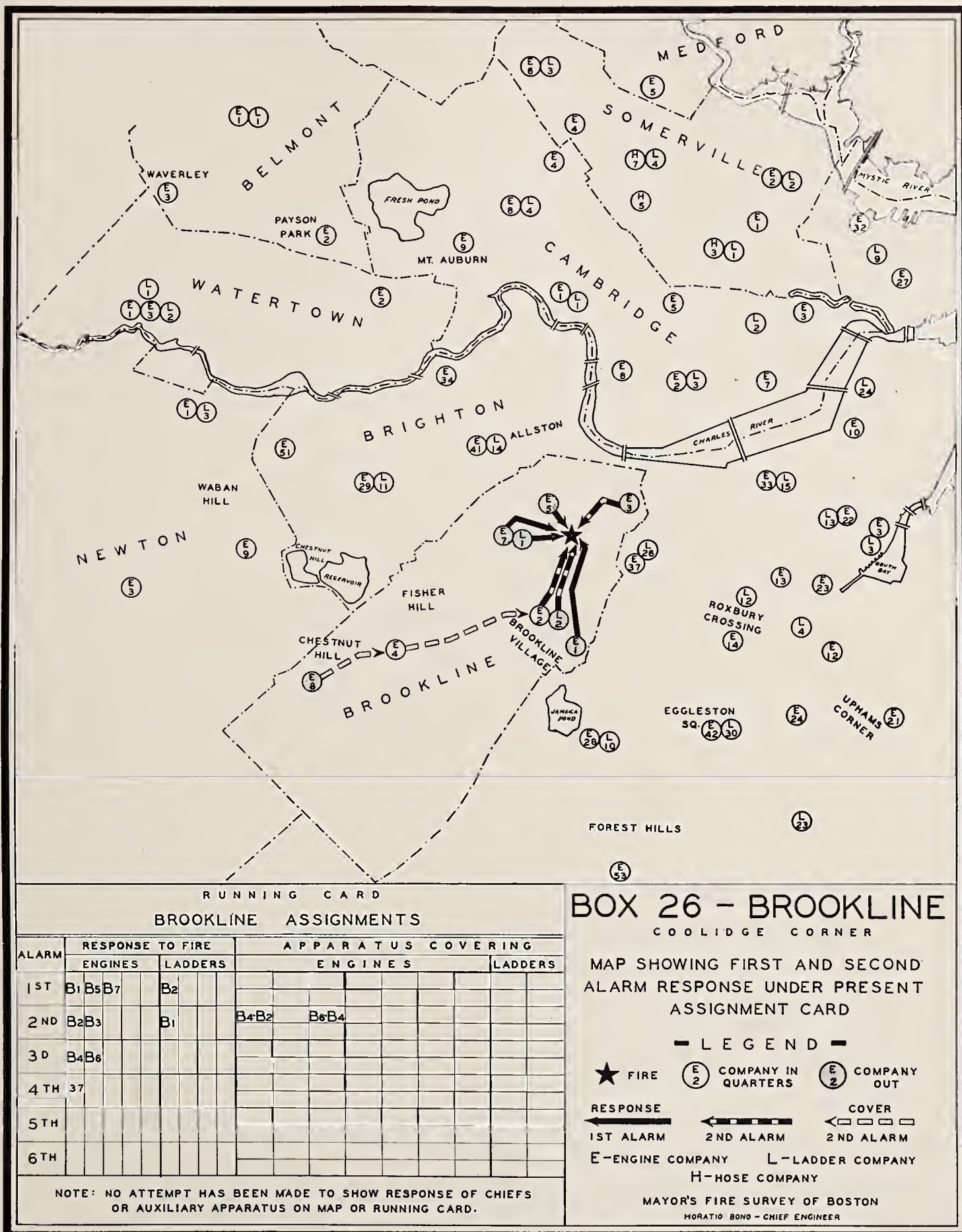


FIGURE 157.

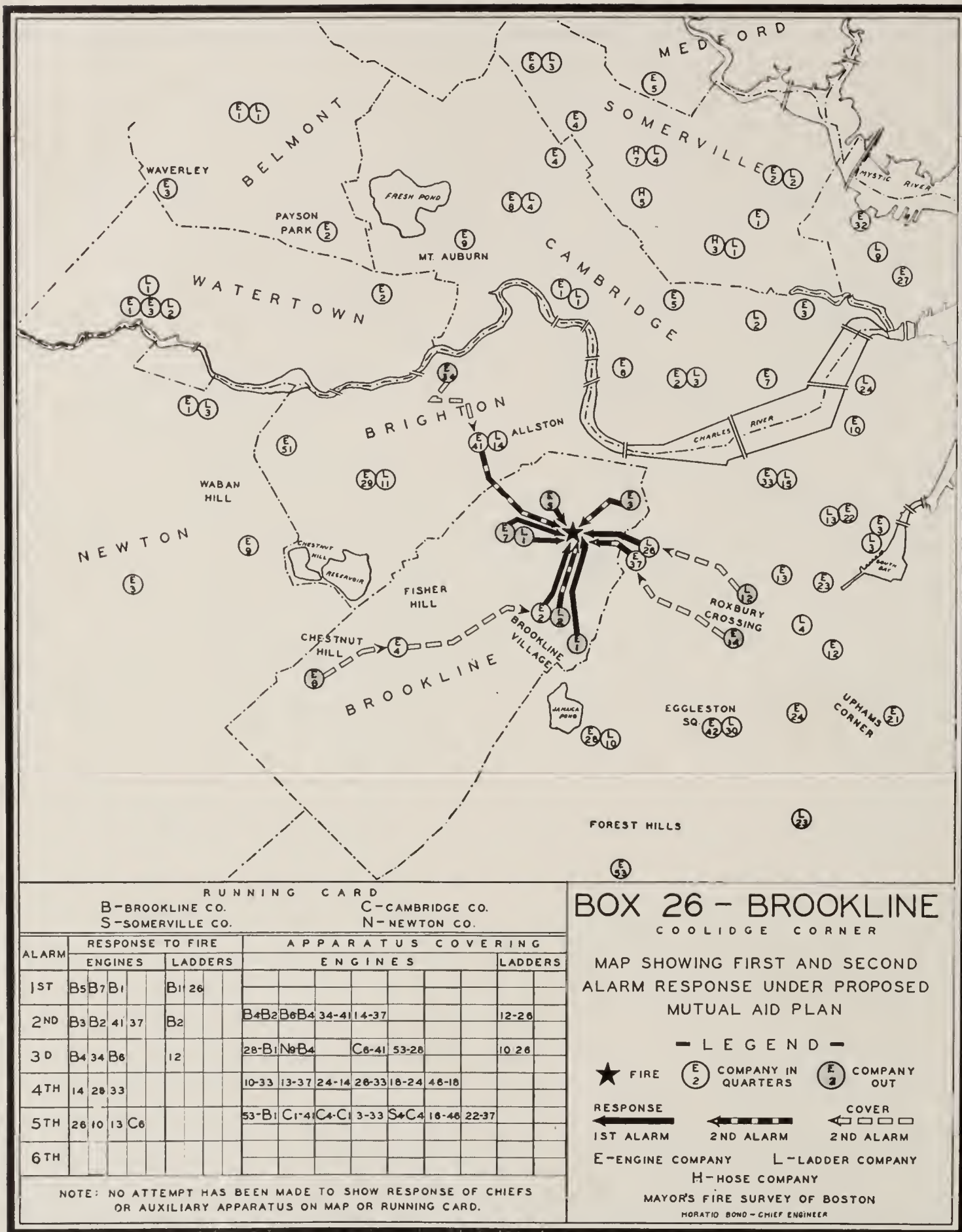


FIGURE 158.

Boston in case of another fire in the Beacon Street apartment area. Under the present agreement Newton and Boston respond with a single engine company when specifically called after a third alarm.

Under a mutual aid plan (Fig. 158) the first alarm assignment to this box would be strengthened by a second ladder company from Boston (Ladder 26) which is most desirable in this particular location. The second alarm assignment would be strengthened by two Boston engine companies, Nos. 41 and 37, which would make the number of companies available on a second alarm equal to the present third alarm response. At the same time adequate protection has been given to vacated territory in event of another alarm.

Further consideration of multiple alarm response embraces the addition of fifth alarm assignments and provides for a total of 17 engine companies as against a definite response of nine under the present system.

East Boston, Box 6134, Marginal and Cottage Streets. On the other side of Boston, in Charlestown and East Boston, the situation is more critical because of the slower and heavy truck traffic, drawbridges and the necessity of using ferryboats in reaching East Boston. This situation has been taken into consideration in the present assignments to alarms from boxes in East Boston, certain companies being instructed to respond by way of Charlestown, Mystic River Bridge and Chelsea, while others report at the ferries for transportation across the harbor.

Fig. 160 shows the present assignments for Boston Box 6134, located at Marginal and Cottage Streets, East Boston, and clearly indicates the conditions now existent in this hazardous district. After a first alarm there is but one engine and one ladder company immediately available for a second fire, and after a second alarm no companies are available until the arrival of Engine 26 from Broadway — assigned to cover-in at the station of Engine 9, Paris Street, by way of Charlestown and Chelsea. Traffic delays on Tremont Street, in the North End, in Charlestown, or delays due to one or all of three drawbridges being open, would seriously impede the progress of this company in reaching East Boston. Of course a company could be detailed from the first fire, but if that fire were such as to require a second alarm such a detail would perhaps be dangerous. In the meantime Chelsea companies would be quickly available. However, they are not included in the present plan of assignments.

In considering the application of a mutual aid plan in East Boston the first consideration has been the speeding up of response. This would be accomplished by the assignment of Engines 1 and 5 of Chelsea on second alarm. This arrangement, with Engine 11 of Boston, would make possible quick response in any part of the district. Engine 36 of Charlestown would cover in to Engine 1 of Chelsea.

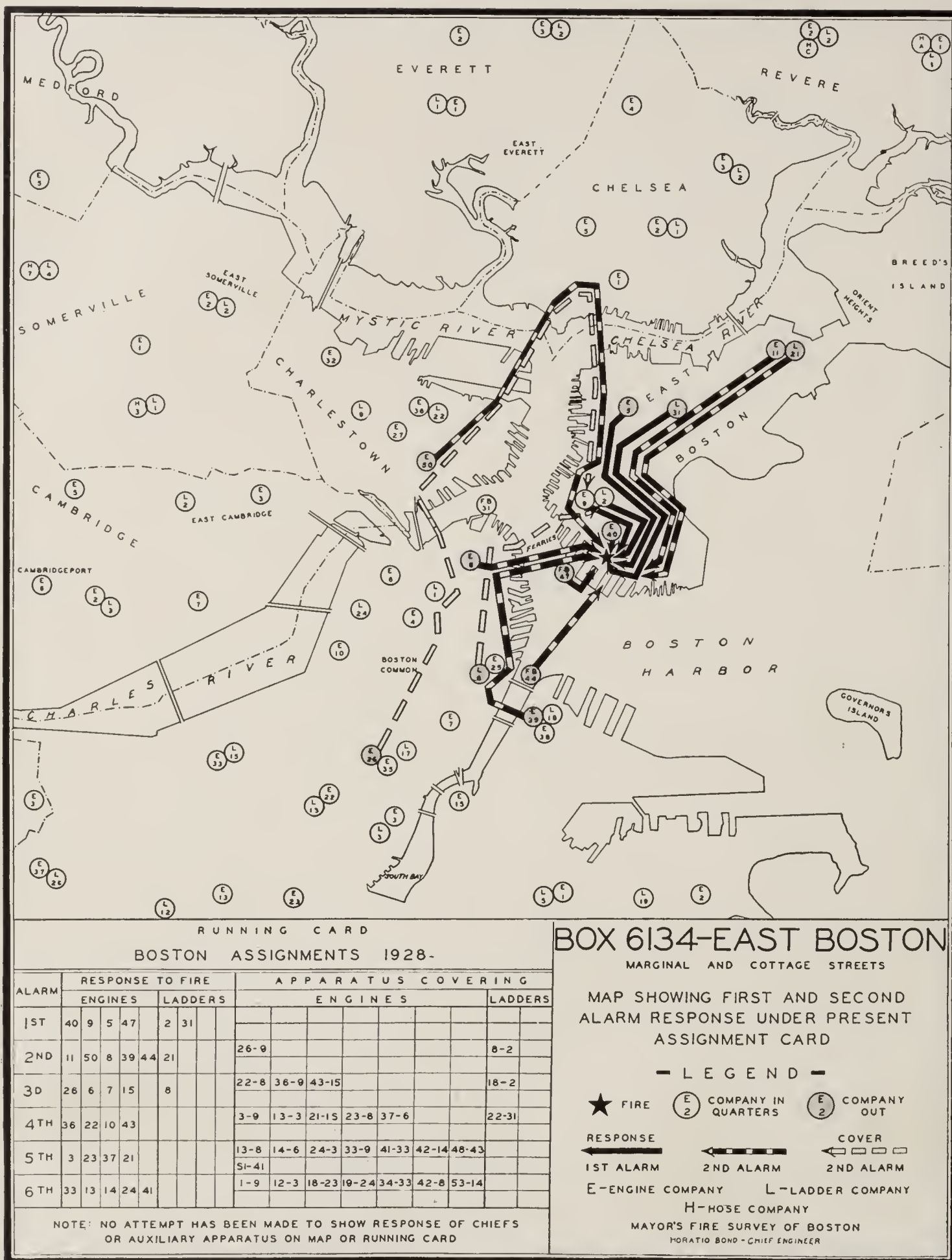


FIGURE 160.

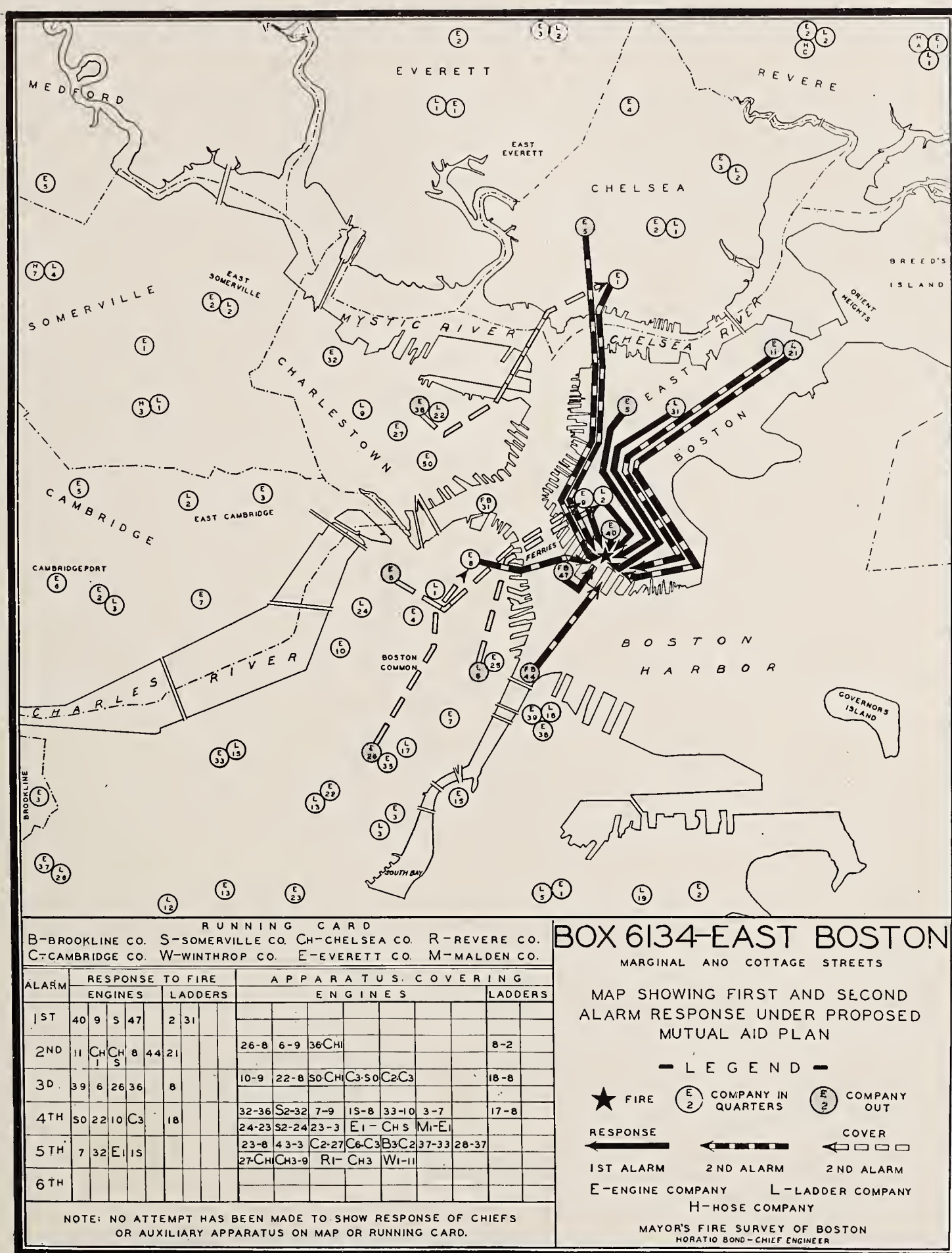


FIGURE 161.

An analysis of response on alarms subsequent to the second indicates an effort to utilize as much apparatus as possible and yet not block the flow of such equipment toward the fire by any one route. Thus by using Cambridge and Everett companies it would be possible to keep apparatus moving toward the fire by way of Chelsea as well as by ferry from the city proper. The accompanying map and assignment card (Fig. 161) will indicate how this could be achieved even though it would necessitate the moving of companies as far out as Engine 3 of Brookline on the fifth alarm.

Cambridge=Somerville Line, Box 195, Cambridge, Box 21, Somerville. For the fourth study, an analysis of response to the territory adjacent to the J. P. Squire's plant, located on the Somerville-Cambridge line on Medford Street at East Cambridge, has been made. Box 195 of the Cambridge fire alarm system is located at the plant and Box 21 on the Somerville system is located at Medford and South Streets, not far away. Figs. 163 and 164 show the present response to these boxes on the present assignment cards and Fig. 165 indicates the proposed assignment under a mutual aid system.

As in other localities it is possible by coordination to increase the response, make possible shorter and quicker runs, and yet more adequately protect vacated territory under a mutual aid plan. A study of Fig. 165, especially its suggested mutual aid assignment card, indicates the possibilities and advantages of a systematic arrangement between Cambridge, Somerville, Medford, Boston, and other cities.

It would be possible to go on indefinitely showing in a graphic way advantages to be gained by the establishment of an adequate mutual aid system but the examples used show conclusively what is to be gained by coordination and cooperation.

LIABILITY OF CITIES AND TOWNS FOR THE COST OF DAMAGE TO FIRE APPARATUS OR INJURY TO FIREMEN BORROWED FROM OTHER CITIES AND TOWNS

Section 59A of Chapter 48 of the General Laws of Massachusetts reads as follows:

SECTION 59A. Cities, towns and fire districts may, by ordinance or by-law, or by vote of the board of aldermen, selectmen or the prudential committee or board exercising similar powers, authorize their respective fire departments to go to aid another city, town or fire district in extinguishing fires therein, and while in the performance of their duties in extending such aid the members of such departments shall have the same immunities and privileges as if performing the same within their respective cities, towns or districts. Any such ordinance, by-law or vote may authorize the head of the fire department to extend such aid, subject to such conditions and restrictions as may be prescribed therein. The words "fire depart-

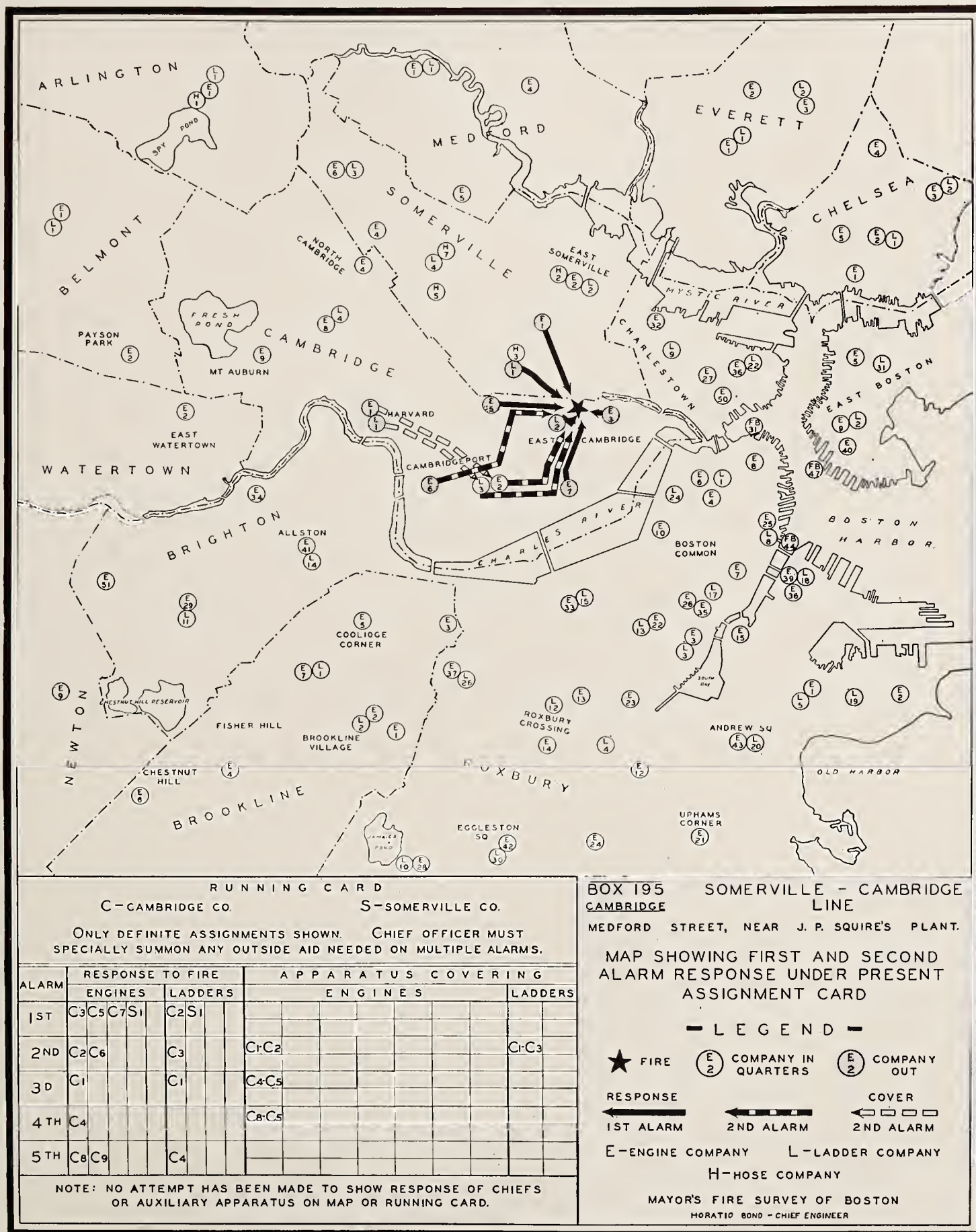


FIGURE 163.

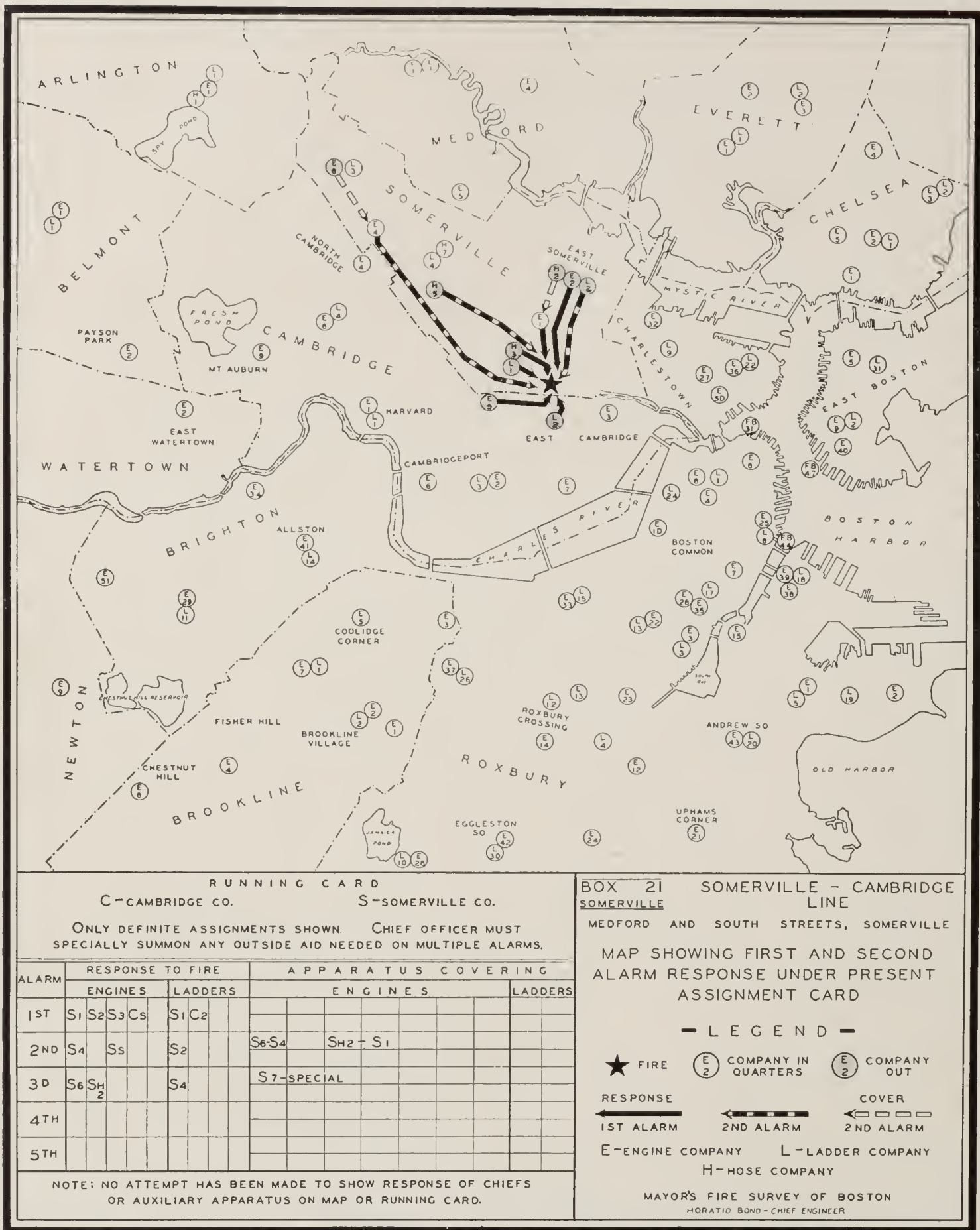


FIGURE 164.

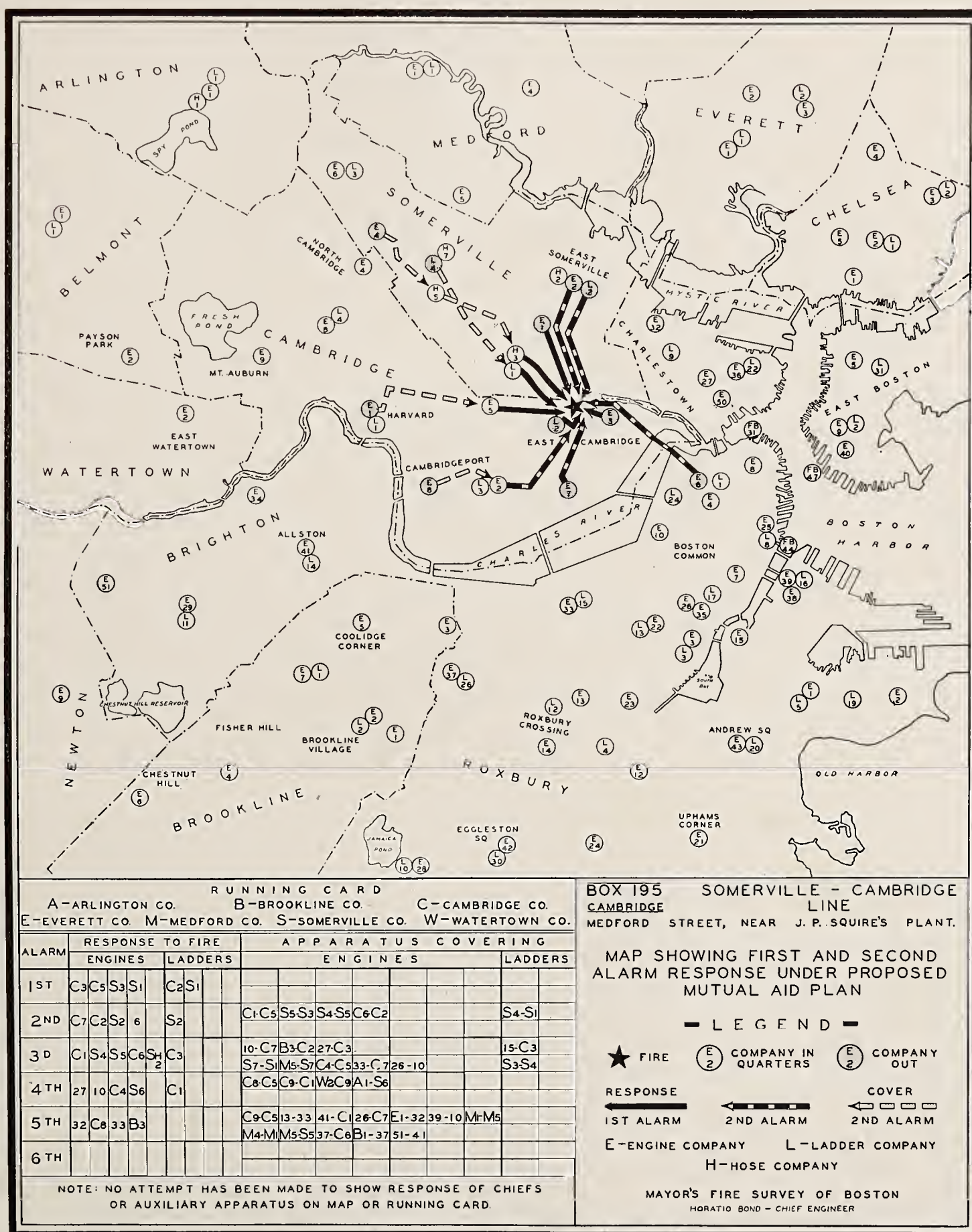


FIGURE 165.

ments" as used in this section shall mean lawfully organized fire fighting forces, however constituted.

Any city, town or district aided under and in accordance with this section may compensate any city, town or district rendering aid as aforesaid for the whole or any part of any damage to its property sustained in the course of rendering the same and may reimburse it in whole or in part for any payments lawfully made to any member of its fire department or to his widow or other dependents on account of injury or death suffered by him in the course of rendering aid as aforesaid or of death resulting from such injuries.

This section provides for fire departments to go to the aid of other cities and towns, if the head of the fire department has been authorized to extend such aid. It further provides that the aided city or town may compensate any city or town rendering the aid for any damage done to its property and reimburse it in whole or in part for any payments lawfully made to any member of its fire department or dependents. This is entirely permissive, and has no force or effect as a law which would compel such cities or towns to reimburse. It is therefore suggested that Section 59A be amended by striking out same and in place thereof inserting the following:

"Cities, towns and fire districts, shall when called upon by the authorized power in charge of the fire fighting force of any other city, town or fire district aid in the extinguishing of fires therein and while in the performance of their duties in extending such aid the members of such department shall have the same immunities and privileges as if performing the same within their respective cities, towns or districts. The words "fire department" as used in this section shall mean organized fire fighting forces, however constituted.

"Any city, town or district aided under and in accordance with this section shall compensate any city, town or district rendering aid as aforesaid for any damage to its property sustained in the course of rendering the same and shall reimburse it for any payments lawfully made to any member of its fire department or of his widow or other dependents on account of injury or death suffered by him in the course of rendering aid as aforesaid, or of death resulting from such injuries.

"The payment of damages or reimbursement for payments so made may be recovered in an action of contract."

SUGGESTED APPOINTMENT OF STATE COMMISSION

In view of the advantages indicated in this chapter of a comprehensive and efficient system of mutual aid between fire departments of Boston and surrounding cities and towns the creation of a commission appointed by the governor to devise and initiate a mutual aid system appears most desirable and is recommended. (See Chapter 15.)

CHAPTER 9

OTHER FACTORS IN PUBLIC FIRE PROTECTION

A. WATER SUPPLY

Report No. 158 of the National Board of Fire Underwriters, published in October, 1925, characterizes the Boston water supply as "adequate and mainly reliable; quantities available generally satisfactory."

Following is a list of the recommendations regarding the water supply made in that report, together with notes on any action which has been taken respecting these recommendations since 1925.

"1. That the recording gages be calibrated so that the full value of their records may be obtained."

The Water Division reports that this condition is being gradually improved.

"2. That an additional 48-inch supply main and artery be installed for the Southern High Service."

Now that the Metropolitan Water Commission has brought a 60-inch supply main to the junction of Pond Street and the Arborway, this can be done. The city now expects to connect this supply by a 48-inch main to the 36-inch High Service at Columbia Road and Geneva Avenue, which will reinforce the present High Service.

"3. That a 36-inch main replace the 24-inch in New Heath Street from Parker Street to Columbus Avenue."

This recommendation has not yet been carried out.

"4. That a 20-inch main be installed in Codman Street from Dorchester Avenue to Adams Street."

This has been done. A 24-inch and 20-inch main, 3,100 feet in length, has been laid in the Southern Artery (formerly Codman Street).

"5. That the promiscuous use of hydrants for purposes other than fire be discontinued, and, if necessary, specific hydrants be designated for such uses."

This practice still persists and results in the condition of some hydrants being uncertain. When unauthorized parties use hydrants, it may render them unfit for use in case of fire.

The Revised Ordinances of 1925 of the City of Boston, Chapter 39, Section 83, specifically state that, without permission of the Commissioner of Public Works, no person shall "unscrew or open a hydrant attached to the water pipes of the city."



A test of the high pressure water system which protects certain portions of downtown Boston. This system is valuable protection and materially lessens the likelihood of another conflagration in the congested district.

It is recommended that a special effort be made on the part of the Police Department to enforce this ordinance, or at least to report all such violations to the Water Division, in order that they may know what hydrants are being used for other than fire purposes.

“6. That the pumping capacity originally contemplated (for the high pressure system) be installed by placing a third pump in each of the existing stations, and two pumps in a third station, and that the distribution system be completed as outlined.”

This recommendation has not been complied with. The full capacity of the present pumping facilities, it was stated, has never been exceeded for even the largest fire thus far experienced. This of course does not signify that a fire of conflagration proportions might not prove a serious load for the present equipment. The fact that the present system has not happened to be overtaxed at any one fire, does not eliminate the necessity of giving serious consideration to this recommendation. It is especially important that the present high pressure system be extended as fast as possible to the entire congested district of the city.

B. THE FIRE ALARM SYSTEM

The fire alarm organization is a division of the Fire Department, and under the general supervision of the Fire Commissioner. It is under the direct charge of a capable superintendent of long experience, trained as an electrical engineer. The headquarters is excellently located in an isolated fire-resistive building. The choice of location and design of the headquarters building is a credit to the city.

The special report of the National Board of Fire Underwriters on the Fire Alarm System issued in March, 1926, as a supplement to Report No. 158, characterizes the Fire Alarm System “as a whole very well housed and installed.” The report further declares that the system “will be adequate for considerable future growth of the city.”

Methods of operation of the system were considered as generally good in this report.

There was only one major recommendation submitted by the National Board regarding Boston's fire alarm system, which was as follows: (For other recommendations see the Special Report referred to above.)

“That present boxes of inferior types be replaced by boxes of modern succession type with box starting handle visible and readily accessible.”

This recommendation is still applicable and should receive consideration. There are approximately 650 of these inferior “interfering, non-succession” boxes owned by the Fire Department in addition to about 200 privately owned. A fire alarm box of this “interfering” type will, when pulled, send in its own particular signal. Frequently several people discover the same fire and each turns in an alarm from a different box and at the same time. If the boxes are on the same circuit, the signals of all the boxes may be lost or confused. A box of the

“non-interfering” type is designed to prevent this. Although better than the plain “interfering” box, the “non-interfering” type still needed improvement because it shut out and caused the loss of any second signal on the same circuit. The “succession” and “non-interfering” type has, therefore, been developed wherein the second signal is not lost but is transmitted as soon as the first signal is completed. This is the standard type of box.



The operating floor of Boston's fine fire alarm central station in the Fenway. Here all fire alarms are received and the movements of apparatus controlled.

The fire alarm division has taken care to distribute these inferior “interfering” boxes so that no two adjacent boxes are of this type. By so doing the seriousness of this defect is somewhat modified. These boxes should, however, be eliminated as rapidly as possible. A definite appropriation should be made each year for this purpose in addition to that necessary for extensions of the system.

There are still, approximately, 300 fire alarm boxes which are not properly lighted. Of these, some are privately owned. It is recommended that all boxes be adequately lighted so that they may readily be located at night in case of fire.

The record of false alarms in 1928 (Chapter 5) indicates that there should be a bell on each box which will ring when the box is pulled. At one time the boxes were equipped with a mechanical gong which rang when the door of the

box was opened. This was unsatisfactory as it gave the impression that the alarm had been sent in when the door of the box only had been opened. After several serious delayed alarms, as a result of these confusing bells, they were taken off boxes so equipped. This was wise, but some signal is desirable that will notify police and other persons in the vicinity when a box is being pulled. Any such signal should, however, operate when the hook is pulled which transmits the alarm.

To sum up, the fire alarm telegraph is under capable direction, excellently maintained, standard except as outlined by the special report of the National Board of Fire Underwriters above referred to, and generally a credit to the city.

C. TRAFFIC CONDITIONS AFFECTING FIRE OPERATIONS

Rapidity of action is fundamental in efficient fire fighting. Millions of dollars have been spent in Boston for an adequate fire alarm system and motor fire apparatus to reduce to a minimum the time required to get into action once fires are discovered. It is recognized that a minute lost may be a matter of life and death, or the difference between a negligible loss and a great one.

Streets are an integral part of the necessary resources of the Boston Fire and Protective Departments. They afford the only channels through which the fire fighting and protective forces can bring their efforts to bear. If their condition is such as to delay operations the efficiency of these departments is lessened.

The narrow streets of the older parts of the city hamper the movement of large pieces of modern apparatus even under ideal traffic conditions. But conditions are far from ideal. These streets are obstructed by traffic to a degree rarely found in American cities. This congestion presents a very serious problem in fire department operation, constituting a constant menace that in a critical situation essential pieces of apparatus will be unable to reach the scene of the fire before irreparable loss has been suffered.

Traffic congestion has a dual effect on fire department operation. In the first place it increases the time required to move apparatus to the scene of the fire. This results from slow moving lines of traffic, the blocking of streets by intersection movements, and the obstructions offered by parking. In the second place it increases the time required to get apparatus into action once it has arrived. This second delay is due almost entirely to parking. Blocked hydrants make quick hose connections impossible. Crowded streets hamper the effective disposition of apparatus. Unbroken lines of parked cars make difficult the laying of hose lines and the movement of personnel from apparatus to sidewalk, and often render impossible the proper placement of ladders.

Instances of Delay. A Deputy Chief of the Fire Department reports: "On most all occasions of alarms of fire during business hours in the congested downtown section of this division we find it very difficult to manoeuver apparatus through our narrow streets. This condition has interfered considerably with the efficient placing and operation of apparatus and appliances in that it has been many times necessary to reroute apparatus in order to get position. Manually operated ladders have on a number of occasions been lifted over the tops of automobiles, or carried considerable distances to a break in the parking, then carried back to building to be raised on sidewalk." Other division commanders report numerous delays ranging from a few seconds to as long as seven minutes.

A not unusual condition is described in the report of the Boston Board of Fire Underwriters on the Hub Moulding Company fire, on Haverhill Street, January 22, 1929. "Under normal conditions the loss sustained should have been small, although the contents of the floor on which the fire started was of highly flammable material, but the Fire Department was greatly handicapped by the large number of automobiles parked in front or near this building on both sides of the street."

The desire for maximum efficiency in fire department operation, the potential danger in present conditions, combine to require the most serious consideration of the specific traffic difficulties at present existing, and methods for their removal.

Recommendations. Planning projects for a more adequate street system in the central and other congested districts, indicate a form of relief for which there seems no alternative, and should be brought to realization as soon as possible.

The comprehensive plan of traffic control and congestion relief, proposed by the Mayor's Street Traffic Survey, should be applied in its entirety.

The Boston Traffic Commission should conduct continuing investigations of troublesome traffic conditions as reported by the Fire Department and recommend rules and methods for their elimination.

Special attention should be given in rule-making to interference resulting from parking. Parking should be prohibited at points where it blocks fire exits, hampers the proper use of fire escapes, or renders sprinkler and other connections inaccessible. Parking should also be prohibited at any points where it hampers the quick exit of apparatus from any company quarters, either of the Fire Department or the Protective Department. Prohibitions should be extended to narrow ways and courts where the Fire Department has experienced or anticipates difficulties, and to private ways where necessary, under authority given by a recent legislative act. There should be a much firmer enforcement of the existing regulation prohibiting the blocking of hydrants.

Fire Routes Proposed. It is recognized that any traffic rules within the scope of reason from the standpoint of normal commercial business would fall far short of obtaining a maximum facility of movement for fire operations. With the cooperation of the Fire Department, attention has been turned, therefore, to developing a plan for the relief of the more critical conditions.

The location of Fire and Protective Department houses results in certain streets being used regularly by apparatus in responding to alarms, which streets may be described as major fire routes. With their connecting streets they afford access to all of the boxes within given districts. Restrictive traffic regulations for fire department assistance on such major routes would be justifiable to a degree perhaps not warranted on secondary routes.

Major fire routes can be developed from a study of fire and protective department practice and delays experienced. The exact routes can be determined by the cooperative effort of the Fire Commissioner, the Traffic Commissioner and the Superintendent of the Boston Protective Department.

It is recommended that the Traffic Commission adopt the following rule, establishing fire routes as may be shown desirable by study of the needs:

Fire Routes: The following streets and parts of streets are hereby declared to constitute fire routes for the purposes of this section:

(Here insert routes as determined)

No operator shall stop, stand, or park any vehicle, except for the purpose of, or for a period of time longer than is necessary for the loading or unloading of passengers or materials, provided that the loading or unloading of passengers shall not consume more than three minutes, upon either side of any fire route as herein described, during any hour of any day.

Suitable signs should be erected along fire routes, and in front of all company quarters of both the Fire and Protective Departments on both sides of the street bearing the legend, "FIRE ROUTE, No Parking at Any Time."

D. BOSTON PROTECTIVE DEPARTMENT (SALVAGE CORPS)

The Boston Protective Department has been operating in the city for the past 55 years, as a fire insurance company organization. The broad definition of the purpose of this department is to prevent water damage at time of fire, to clean up a property after a fire, and to restore sprinkler protection as soon as possible. This work, in reality, is a logical fire department function, but Boston is one of the few cities in which the insurance companies maintain a salvage corps.

The expenses for operation of the department are apportioned among the various insurance companies doing business in the city according to the amount

of their premiums on insurance. The expense in maintaining this department is approximately 2 per cent. of the premiums collected for insuring property against fire in Boston.

There are three companies, located at 124 Broad Street, 4 Appleton Street, and 159-161 Roxbury Street. In addition to these, one man is detailed to a fire department ladder company in East Boston, in Charlestown, and in Hyde Park.

Department operations during and after fires or storms include the spreading of covers over stock or on roofs, the sweeping out of water from buildings and general cleaning up, and the care of sprinkler systems, all for the purpose of preventing unnecessary water damage. Each company also carries chemical extinguishers as first aid equipment for use in case of incipient fires where it may arrive before the fire department.

The department's work in restoring sprinkler protection is very effective. In case it is impossible to restore sprinkler protection after a fire due to lack of authority from the owner, a man is left on duty until the owner arrives and is informed of conditions. When sprinkler protection is not immediately restored, the Boston Board of Fire Underwriters is notified of such conditions by the Protective Department on leaving the property in care of the owner. Valuable work



How the spreading of rubber covers by the Protective Department saves losses is shown by this view of the stock of a clothing store covered to prevent damage by water used in a fire on the floors above.

is also done in repairing sprinkler systems at times of freeze-ups, or mechanical injury to sprinkler heads or pipes, and water damage is thus kept at a minimum.

No particular recommendations are made in this report covering the internal operations of the Protective Department, as it is a privately owned and operated organization, but the desirability of its operation at maximum efficiency is obvious. In the furtherance of this, the department was recently gone over by a salvage corps expert whose recommendations are now under consideration by the directors of the department.

CHAPTER 10

AUTOMATIC SPRINKLERS AND OTHER PRIVATE FIRE PROTECTION

There is a limit to what the city can accomplish by municipal action. Such laws as may be enacted for fire safety are necessarily minimum requirements made under the general authority of the "police power" which enables communities to provide for the safety of the public in general. While living up to legal requirements will help, this cannot alone reduce to a minimum the general burden of the fire loss. The provision of further refinements for the fire protection of individual properties is dependent upon the individual owners' initiative. On them rests the responsibility for keeping their property in order, for eliminating defects in construction and for providing adequate fire protection.

This chapter should be of particular interest to the property owner and the various commercial and industrial concerns throughout the city, as it deals with the value and efficiency of various resources which are available for the adequate fire protection of their property.

AUTOMATIC SPRINKLERS

The automatic sprinkler has had a very important influence in reducing the fire loss in Boston and in the country as a whole — much greater than is generally supposed. It is well recognized that the general introduction of sprinklers in hazardous buildings in towns and cities has very greatly reduced the danger of conflagrations. This is especially true of Boston. While thousands of fires throughout the country are extinguished each year by sprinklers in properties so equipped, in no case has a fire which started in a property fully and adequately equipped with sprinklers extended to other properties and thereby caused the loss of several buildings or started a conflagration.

Most conflagrations can be directly attributed to fires starting in large area or hazardous properties. Many conflagrations would have been prevented if such properties had been equipped with sprinklers. The gradual elimination of the "conflagration breeder" (discussed in Chapter 1) due to the installation of sprinklers in buildings, which because of height, area, combustible contents, and hazards, may get beyond fire department control, is tending to make Boston and other cities safe from this great menace to community and country-wide prosperity.

In large mercantile or industrial buildings of high-value occupancies the reduction in insurance premium cost will generally pay for the cost of sprinkler equipment in a few years, or at least provide good returns on money so invested.

There are, however, many properties where safety to life and property is of primary importance, or where the menace to other property is such that automatic sprinklers should be installed, even though the saving in premiums does not make the cost of sprinklers a particularly attractive investment.

This problem of what properties should have sprinkler protection is necessarily a civic problem because it affects the welfare of the community as well as the individual.

The Boston building code and other laws recognize the value of automatic sprinklers. With such protection greater heights and areas for industrial or other



International Photo.

A fire in a market district block in downtown Boston. The block is divided by fire walls into sections separately occupied, the one in which this fire occurred being occupied by food and paint wholesalers and was unsprinklered. This block has been the scene of many fires and in several cases the combustible interior construction and unprotected vertical openings resulted in serious ones. Losses in three fires alone have aggregated over \$500,000. The occupants of several of the sections where bad fires have occurred have since installed automatic sprinklers.

buildings are permitted. It affects the requirements for exits. It reduces the other fire protection necessary for manufacturing, or other processes or methods which introduce unusual or serious fire hazards.

The State Department of Public Safety issues regulations which require sprinklers in certain garages. The State Fire Marshal may require sprinklers in certain buildings considered fire menaces, but he is restricted in these latter instances by the provision that in no case can sprinklers be required if the cost of installation exceeds 5 per cent. of the assessed valuation of the property, unless four or more persons are employed above the second floor. (General Laws, Chapter 148, Sections 36 and 41.) The former restriction has greatly hindered effective results from this law. For example, the fact that sprinklers would cost more than 5 per cent. of the assessed valuation does not make the building any less a fire hazard.

Another factor preventing the marshal from taking full advantage of this law is the fact that as far as can be determined he has never issued any regulations for the guidance of property owners regarding sprinkler installations. This, the courts have held (*Commonwealth v. Badger*, 243 Mass. 137), he must do. (See also Chapter 13.)

The Boston building code contains the following requirements for automatic sprinklers. The Building Commissioner has provided a set of regulations for their installation under which he may require sprinklers as the code provides.

1. The Building Commissioner may order the basements of any mercantile building hereafter erected to be sprinklered when not otherwise required by law.

2. Sprinklers in theaters are required in all areas at the rear of the proscenium arch, under stage, in dressing rooms, smoking rooms, offices and similar places.

3. Sprinklers are required in tenement or apartment houses hereafter erected of second or third class construction, being more than three stories high and containing more than ten suites, in the basements or cellars, kitchenettes, stairway and elevator enclosures, light, ventilating or dumb-waiter shafts. Sprinklers may be required by the commissioner in similar first-class constructed buildings in the basements if in his opinion a fire hazard exists. The basements of existing tenements or apartment houses of second and third class construction of more than three stories high are required to be sprinklered.

These building code provisions regarding sprinklers have greatly aided the control of fires in these specific properties (Chapter 4) which clearly indicates what results could be obtained by a more universal use of this type of protection.

The record of automatic sprinklers for the last five years has been presented in detail in Chapter 4. This shows that for properties of like character, the losses where sprinklers are provided are much lower than in unsprinklered properties. This is most marked in the properties where large values are involved.

Values Protected by Automatic Sprinklers. It has been estimated that automatic sprinklers protect over thirty billions of dollars in property values in the United States. A similar figure for Boston would be desirable, as without it the significant value of automatic sprinkler protection is not clearly apparent. A rough estimate has been made. It is based on the following factors: The assessed value of buildings equipped with sprinklers, a comparison of the assessed value with the amount of insurance carried on certain buildings, and a comparison of the relative amount of insurance carried on buildings and contents.

From the above factors the amount of insurance carried on the 1,500 or 1,600 properties equipped with automatic sprinklers in Boston is estimated as between one and one and one quarter billions of dollars. The actual property value so protected is probably something above this figure. The average losses per year in this sprinklered property over the last five years were about \$520,000.

Considering the value of sprinklered property, as compared with the probable total values in the city, it can be estimated that the losses on sprinklered properties are somewhere between 10 and 15 per cent. of the losses in unsprinklered properties of equal value.

In view of this record, the property owners in Boston, who have not installed automatic sprinklers, particularly where large values are involved, have not done their full share in helping to reduce the fire loss in Boston. Many of the large fires have been occurring in properties which might have been equipped with automatic sprinklers at very little cost, if the saving in insurance premiums over a period of years was taken into account.

Recommendations. The conclusion is very evident that automatic sprinklers have had a material effect in reducing the fire loss in the city, and in safeguarding against serious fires and conflagrations. The following recommendations are therefore made.

1. Automatic sprinklers should be more universally installed by all property owners, particularly in the following types of buildings:

- (a) Those which, because of area, height, construction, or occupancy, constitute a fire menace to other property.

- (b) Those which contain high values or are in any way hazardous, regardless of whether they are a menace to surrounding property or not.

- (c) Those in which lives are endangered due to construction or occupancy.

2. In the provision of Chapter 148, General Laws, permitting the marshal to require sprinklers in buildings deemed a fire menace, but limiting such order to cases where the cost is not more than 5 per cent. of the assessed valuation, the limit should be removed.

3. Suitable regulations for the installation of automatic sprinklers should be at once adopted by the State Department of Public Safety.

YARD HYDRANTS AND PRIVATE SYSTEMS OF WATER PIPING

There have been occasions in the past where fires have occurred in large private properties where the lack of an adequate system of water piping to feed water from the street mains to yard hydrants has prevented the efficient operation of the Fire Department. Long lines of hose had to be laid from distant hydrants, with resultant delay in getting at the seat of the fire. Where a plant covers considerable area, the owners of such properties should provide a private water system and hydrants to protect their property.

STANDPIPES IN BUILDINGS

The necessity of adequate fire protection for buildings of considerable height resulted in a law being enacted in 1923, which required fire department standpipes in all buildings hereafter erected exceeding 70 feet in height. This act also requires the installation of standpipes which supply hand hose throughout the building. Previous to this there had been no law establishing any standards for standpipe installations. As a result there are now many old buildings equipped with standpipes which have hose connections of varied sizes, to which it is often impossible for the Fire Department to attach their standard $2\frac{1}{2}$ -inch hose couplings. These old outlets vary in size, being commonly found in $1\frac{3}{4}$ inch and 2 inch sizes with some having standard $2\frac{1}{2}$ -inch outlets. Some of the main risers feeding these outlets are 2-inch pipe, whereas the minimum size riser considered adequate on a standard fire department standpipe today is 4 inches in diameter, and increasing according to the height of the building. When the building code is revised it should include standards requiring these old standpipes to be equipped with proper outlets so that they can be utilized by the Fire Department.¹ Naturally, the present conditions render this old equipment a very uncertain item of fire protection.

¹ In the meantime the following plan is recommended:

First, old standpipes with main risers of less than 3 inches diameter should be considered "first aid" equipment only, and orders so issued by the Fire Commissioner to the fire fighting force. The owners of buildings with such standpipes should be requested by the Fire Department to provide $1\frac{1}{2}$ -inch outlets, by the use of reducing couplings or otherwise. The Fire Department should then be equipped with a small amount of $1\frac{1}{2}$ -inch hose and nozzles with $\frac{1}{2}$ -inch tips for use on such standpipes. Buildings so equipped should then be plainly marked on the outside near each door indicating the size of the standpipe riser and outlets. By this plan, if the Fire Department carried this first aid equipment, on arriving at a fire in buildings so labeled, they could immediately put in play this first aid line, while the standard lines were being laid.

Second, where old standpipes are fed by a 3-inch or larger riser, the owners of the buildings in which such systems are located, should be requested by the Fire Department to provide standard $2\frac{1}{2}$ -inch outlets to which the Fire Department can connect their standard hose. These buildings should also be labeled by small but conspicuous signs near doors, indicating the size of the standpipe riser and outlets, so the Fire Department can see at a glance the kind of equipment in the particular building.

The Fire Department apparently uses old standpipes whenever it is possible or advantageous, but the varied conditions mentioned have contributed to inefficiency in the use of such equipment. The improvements requested of property owners can only be secured through voluntary action on the part of such owners, as the law governing standpipes is at present not retroactive.

At present, the Building Department tests or examines, yearly, all standpipe hose and equipment installed since 1923, but makes no attempt to test standpipe equipment installed previous to that date. Fire Department officers should inspect this old equipment at frequent intervals to at least acquaint themselves with its value and condition. A record should be kept of its probable reliability.

PRIVATE FIRE ALARM AND WATCHMAN'S SERVICE

If every fire could be discovered in its incipency, its extinguishment with very little loss could be practically assured if the Fire Department and other protective agencies were on hand to function. Any appreciable delay in the discovery of a fire usually results in heavy losses. It is therefore essential that property owners give every consideration possible to provide reliable and adequate fire alarm protection, especially where high values are involved. Modern science has provided several reliable types of such alarm service. The more common methods employed are outlined in the following pages. In presenting this discussion, no attempt has been made to list the various methods in any order of their relative importance. There are five main divisions for classifying private fire alarm protection as follows:

(1) Private Watchman recording on Local Clocks, (2) Supervised Watchman's Service, (3) Manual Fire Alarm Systems, (4) Automatic Fire Alarm Systems, and (5) Sprinkler Supervisory Alarm Systems.

Watchman Service, with Local Clocks. A watchman, ringing in his rounds on a watchman's clock furnishes one type of private alarm service. There are two types of watchman's clocks which may be employed. One is known as a stationary clock, which consists of a master clock with a recording dial, and stations located at various advantageous points throughout the property in question, which, when rung manually, automatically record the number of the station and the time on the master clock dial. The other type of clock is the portable clock which the watchman carries with him, and by means of different keys, located about the property, he rings in each station on a recording dial contained in the portable clock. Checking of these records each day by someone in authority furnishes evidence of the watchman's activities the night before.

Supervised Watchman's Service. Supervised watchman's service consists of manual boxes located throughout a property which are rung in by a watchman in making his rounds, and by so doing transmit a signal to a central station,

maintained by service companies. If a watchman fails to record a station within reasonable time, a runner is sent out from the central station to ascertain the cause for the failure to receive the watchman's signal.

Manual Fire Alarm Systems. There are two types of manual fire alarm systems. In both, private fire alarm boxes are located throughout a property which may be operated by anyone in case of fire. Under one system, if a private box is pulled it transmits a signal to a central station, where operators, in turn, can transmit the alarm to the city fire alarm headquarters. In the other type of system, known as an auxiliarized system, the private boxes are tied in with the nearest city fire alarm box, so that the latter signal sounds at fire alarm headquarters, whenever one of the private fire alarm boxes within the property is operated.

Automatic Fire Alarm Systems. There are several types of automatic fire alarm systems which owners can employ in the protection of their property. The general principle of these systems is based on the effect of heat on indicating devices amply distributed throughout the property. They may be arranged so that heat will expand or fuse metal, or cause the expansion of air. One type of device uses a thermopile in which a change of temperature causes the generation of a small electric current. Most of these devices operate when a fixed temperature develops. Others are designed to operate when the temperature increases at a dangerous rate. The latter type can be very sensitively adjusted and are frequently used to operate valves supplying water to open sprinklers, close fire doors, shut down ventilating systems and in other ways make possible the prompt detection and control of fires. When the thermostat or other device operates, it sends in an alarm to a central station from which it is relayed to fire alarm headquarters.

Sprinkler Supervisory Alarm Systems. Sprinkler supervisory alarm systems are entirely automatic and of a number of types. One is termed "water flow" supervisory. Under this system if water starts flowing in a sprinkler system, due to heat fusing a sprinkler head, or due to mechanical rupture in the system, an alarm is sent to the central station, whence it can be transmitted to fire alarm headquarters. In addition to this water flow supervisory, it is possible to supervise various equipment connected with the normal operation of a sprinkler system, such as gate valves, air pressure in dry pipe systems and gravity or pressure tanks. In these cases an alarm is transmitted to the central station if a sprinkler control valve is shut, if the pressure gets low on an air system, if the pressure gets low in a pressure tank supplying sprinklers, or if a gravity tank supply gets low.

Such automatic alarm service is valuable both because it furnishes prompt notification of fire, and also because it keeps those in authority automatically informed of the condition of all equipment.

In studying the sprinkler fire record in Boston, the few large losses in sprinklered buildings over a five-year period were more the result of water damage than fire. (Chapter 4.) These losses were further aggravated in Boston by poor construction and lack of water-tight floors. The more universal use by property owners of sprinkler supervisory alarm service, or some type of automatic fire alarm will surely result in lower losses in that class of property.



A tenant mercantile and manufacturing block in downtown Boston. There have been two serious fires within three years in unsprinklered buildings in this block. The losses in these fires have been heavy, aggregating well over a quarter of a million dollars. Had these buildings been sprinklered the same as the majority of the other buildings in this block, the fires would probably have been controlled with small loss.

Fire Department Response to Private Fire Alarm Signals. The matter of Fire Department response to supervised alarm service is somewhat involved. At the present writing private supervised alarm signals, which are transmitted to fire alarm headquarters, receive varied assignments. "Still" alarm apparatus (usually one engine and a ladder truck) is sent on some signals during the day, some signals have "box" alarm response (at least four engines and two ladders). Plans are now under way to provide box alarm response to all private supervised fire alarm signals (which are transmitted to fire alarm headquarters) during the night, Sundays or holidays.

The present provisions for response to some supervised alarms whereby only still alarm apparatus is sent does not seem logical. If there is a fire in a building and some one pulls a city box, full box alarm apparatus is sent regardless of the time of day. Assuming the same fire, detected first either by a private manual box alarm coming in, or a sprinkler supervisory signal (both of which could be transmitted to fire alarm headquarters) only one engine and ladder (still alarm response) would be sent, if it was during the day. False alarms, it is true, occur at times in connection with such supervisory systems, and needless runs might be made. However, the percentage of false alarms thus received is probably no greater, in proportion to the number of systems, than are those occurring from public boxes, in proportion to the total number of such boxes. It seems logical that full response (box alarm apparatus) should be sent on all alarms transmitted to fire alarm headquarters by private central stations. At least such should be the case between the hours of 5 p. m. and 8 a. m. daily, and for 24 hours on Sundays and holidays. The hour of 5 p. m. has been chosen, as the hour directly after closing time is a "danger" hour for fires. Tenants have just left the buildings and "careless smoking" fires, and the like, are prevalent at that hour.

Recommendations. In view of the value of all types of automatic fire alarm service in keeping fire losses low, the following recommendations are made:

1. The owners of buildings equipped with automatic sprinklers should provide either sprinkler supervisory alarm service or some type of supervised fire alarm service.
2. At least some form of supervised automatic fire alarm service should be provided for large private residences and for such properties as house particularly valuable, easily injured or irreplaceable contents.
3. Arrangements should be made so that on all supervisory or automatic alarm service signals transmitted to fire alarm headquarters, box alarm apparatus is assigned during 24 hours per day, or at least daily between 5 p. m. and 8 a. m., and for the 24-hour period Sundays and holidays.

PROTECTIVE EQUIPMENT FOR SPECIAL FIRE HAZARDS

It is pointed out in Chapter 13 that the state and city regulations for the protection of special fire hazards are very meager. Even at their best, they are minimum requirements. It is therefore essential that every property owner, manufacturer or commercial organization, assume the responsibility of adequately protecting any special fire hazards incident to its business. No attempt is made in this report to mention the numerous modern private fire protection

devices that are available to the public, but competent fire protection advice should be sought to the end that wherever hazardous operations or processes are prevalent in any industry or occupancy, such fire hazards be adequately safeguarded.

FIRST AID FIRE APPLIANCES

The more universal use of the various types of first aid fire appliances such as small hand hose, chemical extinguishers, water pails and the like by property owners in Boston is strongly urged. At the time of an inspection of various properties throughout the city such equipment in many cases was entirely lacking, and frequently where such equipment was employed, it apparently received little periodical attention.

There are various first aid fire protection appliances available to property owners. Such equipment should be carefully selected for its designed purpose.

The fire prevention division of the Fire Department should inspect all first aid appliances as part of their duties in order to keep such equipment in adequate working condition for use in fire emergencies. It was found on inspecting some properties that chemical extinguishers had not been periodically recharged, fire pails were either empty or contents frozen, and in some cases such first aid equipment was located in inaccessible places.

In general the selection of first aid fire fighting appliances should be governed by the character of the combustible material present and the hazards of occupancy to be protected. Competent advice should be sought as to what equipment would be the most advantageous for the individual owner to employ as adequate protection for his particular property.

A MESSAGE TO BOSTON PROPERTY OWNERS AND INDUSTRIES

One of the main objects of this report is to reduce the fire waste in the City of Boston. The major part of the report is devoted to a study of the operation and efficiency of all city or state departments which are responsible, in any way, for the prevention or control of fire. The attempt has been made to indicate how and where improvements should be made on the part of these departments in order for them to better control the fire waste. In the last analysis, however, it is the conditions which exist in every individual property in Boston which really are responsible for the fire loss. If every property owner or occupant of a building were actually doing all he could to prevent fires, the fact that deficiencies might exist elsewhere would not be so vital as now. No report would be fair to the various municipal or state agencies dealt with extensively in these pages, unless the frank statement is made that gross negligence on the part of many property owners and tenants of buildings is a great factor in Boston's fire loss.

The following are a few questions which the individual property owner should ask himself regarding his property:

1. Is my property kept in a clean and tidy condition?
2. Could the Fire Department use the standpipe in my building?
3. Is my stock so piled or stored that the Fire Department can easily gain access to any floor?
4. Are there openings through floors, such as stairways or elevators, belt holes, dumb-waiters or shafts, which would spread fire rapidly because not properly enclosed?
5. Do I see that my fire doors or shutters are closed nights, Sundays and holidays?
6. Is my property equipped with the necessary first aid fire extinguishing devices?
7. Have I, incident to my business, any special fire hazards which are in need of further special fire protection?
8. Is there danger to the life of those working or living in my building in the event of fire?
9. Should my building be sprinklered because of its area, height, values involved, and kind of occupancy?

What the Fire Record Shows. Chapters 3, 4, 5 and 6 contain such information as could be obtained from studying the fires which have occurred in Boston. A brief recital here of the difficulties in obtaining from the existing fire records adequate data for study purposes will show what is lacking in the procedure now followed in investigation of fires.

Fire Reports. Fig. 187 shows the blank executed by the district chief in charge of a fire. This report indicates what apparatus responded and what officers were in charge, but little or no detail is given as to how the fire spread, or how the available apparatus was employed in extinguishment. The operation of each company at a fire is reported on a separate blank. These do not go into as much detail as they should, and the several reports must be assembled in order to get a fair idea of how the apparatus was used. These reports are not filed with the fire record reports, and therefore are of no help in studying that record.

The district chief's report gives his opinion as to how and where the fire started so far as can be determined. The extent of the fire is sometimes given, but usually in such general terms that the information is of little value. The general method of extinguishing the fire, *i. e.*, by extinguishers, chemical streams, hose lines, etc., is frequently stated, but there are usually no details. The location of the fire (address) is given, the general dimensions of the building, whether brick or frame, the owner, and the names of the principal occupants whose premises were involved. The report also contains the best estimate of the district chief of the loss on buildings and on contents. This loss is later checked by reference to the files of the Boston Protective Department and the report when finally filed, contains the relatively accurate figures of that department, as well as the chief's estimate.

Such of the above data as is required, is reported to the State Department of Public Safety on cards furnished for the purpose, one of which is shown in Fig. 189.

From the fire data reported to it on the card illustrated above, the State Department of Public Safety attempts to make up a table of occupancy data. The effort is of little value, because the unreliability and indefiniteness of the original data make it necessary to choose very general classes and this results in large totals for classes such as Storehouses and Warehouses, Factories and Workshops and the like. (For Causes of Fires and Occupancy data, see Chapters 4 and 5.)

NEED FOR THOROUGH INVESTIGATION OF FIRES BY TECHNICAL MEN

The need for technical data on fires is acute. At present there is no systematic study made of fires as they occur, so that the lessons that may be drawn from them may be applied to preventing the start of other fires or of lessening fire damage from those that start in spite of fire prevention work.

REPORT OF FIRE REQUIRED BY STATE

CARD SIZE — 4 × 6 INCHES

FORM F. P. 12 50M 11-27 NO. 554

FIRE REPORT

No.

DEPARTMENT OF PUBLIC SAFETY - DIVISION OF FIRE PREVENTION

CITY OR TOWN OF STREET AND NUMBER

DATE OF FIRE 192 TIME A. M. P. M. BOX NO.

CHARACTER OF FIRE POINT OF ORIGIN
(BUILDING, BRUSH, AUTOMOBILE, ETC.)

CLASS OF BUILDING NEAREST R. R. STATION
1ST, 2ND, OR 3RD, WOOD, STUCCO, STONE, BRICK, CEMENT

HOW OCCUPIED
(DWELLING, TENEMENT HOUSE, KIND OF STORE, KIND OF MANUFACTORY)

OWNER OTHER FIRES OF OWNER

ASSESSED VALUE OF BUILDING \$	TOTAL INSURANCE ON BUILDING \$	DAMAGE TO BUILDING \$	INSURANCE PAID \$		
OCCUPANTS SUSTAINING LOSS	ESTIMATED VALUE OF CONTENTS	TOTAL INSURANCE ON CONTENTS	DAMAGE TO CONTENTS	INSURANCE PAID ON CONTENTS	OTHER FIRES
.....
.....

NOTE DO NOT HOLD REPORT FOR INSURANCE FIGURES. IF NOT READILY OBTAINABLE SEND THEM ON A LATER REPORT

FRONT SIDE

WERE FOUR OR MORE PERSONS LIVING OR USUALLY EMPLOYED ABOVE THE 2ND FLOOR ?

CAUSE OF FIRE (GIVE DETAILS OF FACTS AVAILABLE) :—

LOSS OF LIFE MEN WOMEN CHILDREN

WAS FIRE RESULT OF CARELESSNESS OR DESIGN ?

CHIEF OF FIRE DEPARTMENT

CHAIRMAN, BOARD OF SELECTMEN
(DO NOT WRITE BELOW THIS LINE)

REFERRED TO INSPECTOR DATE 192

FULL REPORT RECEIVED 192
CHIEF FIRE INSPECTOR,

BACK SIDE

MAYOR'S FIRE SURVEY OF BOSTON
HORATIO BOND — CHIEF ENGINEER

FIGURE 189.
(189)

In the case of building fires the recorded data is so meagre it has not been possible to use it in making any suggestions on fire-fighting methods. The study of grass and brush fires, however, revealed how these can be localized, both as to time and locality, and as an example shows how the fire record suggests a special means of attack on a particular kind of fire.

If the art of fire fighting is to progress it must be built upon a study of the accomplishments or the mistakes made at fires in the past. If data is available in thorough reports on every fire, this profession may be materially advanced.

The kind of fire report obviously necessary, must be more detailed than a district fire chief can find time to make incidental to his fire-fighting duties. Some engineering training is required to evaluate the factors and results of a fire satisfactorily. The Fire Department should therefore have on the technical staff, recommended in Chapter 7, two or more men competent to record and preserve the technical details of fires. These men should make a report covering the items called for on the standard fire report form worked out by the Fire Record Committee of the National Fire Protection Association or a similar blank. Two such blanks are illustrated in Figs. 191 and 193, showing the great variety of technical items which must be covered before a report on a fire means anything for future study.

It is essential to know to what extent the spread of fire is due to faulty building construction, combustible contents, or failure of extinguishing agencies, watchmen or other protection. Was a delayed alarm a factor? Were there obstructions to sprinklers that hampered their effectiveness? Was there too little water in the street mains making it impossible to get enough on the fire? Were there delays in the arrival of any companies of the Fire Department? Would the fire have been better fought if the fireman were better trained in the use of certain apparatus? Would certain apparatus, not available at the time, have helped to control the fire? Did the officers of the Department use good judgment in handling the fire? These and many similar questions are the ones a real fire report should answer.

On the basis of such a report, if construction or occupancy is at fault, the necessary changes in the building code or fire prevention regulations can be made. If the fire protection failed, steps can be taken to see that it does not fail the next time. Thus the report may have a definite value in planning the direction of fire prevention activities along practical and profitable lines.

ARSON

That the setting of fires, or arson, is a cause of fires in Boston has already been indicated by Chapter 6.

Since arson causes a large proportion of the loss a proportionately greater amount of effort should be put into apprehending and convicting the persons who are responsible for it.

GENERAL REMARKS.—Please write up full account of fire in narrative form, but cover particularly the following points:—1. Complete details of cause. 2. Extent of fire. 3. Cause of large loss. 4. General construction of plant as a whole. 5. Details of cut-offs where a factor: fire walls, fire doors. 6. Details of protection against exposure where a factor: shutters, wire glass windows. 7. Management. 8. Details of failure in alarm service. 9. How fought. 10. Amount of apparatus used. 11. Action of fire protection devices; and reasons for any failure. 12. Wind. 13. Temperature (if unusual, especially if cold). 14. Loss of life. 15. What was done by Assured or Fire Patrol to protect property after fire. 16. Condition of fire appliances after fire. 17. Lessons of Fire. 18. Recommendations. 19. Make a sketch where appropriate.

(BACK SIDE)

FIGURE 191.
(191)

Authority for Investigation of Fires. The following sections of Chapter 148 of the General Laws provide the authority for the investigations of fires in the state.

SECTION 3. The marshal in Boston, the Board of fire engineers in cities and in towns in which such a board is established, whether the organized fire district includes within its limits the whole territory of the town or not, and the selectmen in towns in which no fire district is organized and no board of fire engineers is established shall investigate the cause and circumstances of every fire in such city or town by which property has been destroyed or damaged, especially to ascertain whether it was caused by carelessness or design. They shall begin such investigations within two days, excluding Sunday, after such fire, and the marshal may, in his discretion, supervise and direct the same. The board making investigations of fires may notify the said marshal, and shall within one week after the fire file with him a written statement of all the facts relative to the cause and origin of the fire, the kind, value and ownership of the property destroyed, and such information as he may require. He shall keep in his office a record of all fires occurring in the commonwealth with the results of said investigation. Such record shall be open to public inspection, and copies of such portions as the commissioner of insurance requires shall be forwarded to him before January fifteenth.

SECTION 4. The marshal shall investigate or cause to be investigated the cause and circumstances of all fires of which he has notice, as provided in the preceding section, by which property has been damaged or destroyed, especially to ascertain whether the fire was caused by carelessness or design. For these purposes the marshal or some person designated by the commissioner may summon and examine on oath any person supposed to know or have the means of knowing any material facts touching the subject of investigation. Such witnesses may be kept apart and examined separately, and such examination shall be reduced to writing, and false swearing therein shall be deemed perjury and be punishable as such. Any justice of the municipal court of the city of Boston or of the superior court, upon application of the marshal or some person designated by the commissioner, may compel the attendance of such witnesses and the giving of such testimony before him in the same manner and to the same extent as before said court. If upon such investigation he believes that the evidence is sufficient to charge any person with crime in causing the fire, he shall make a complaint therefore and shall furnish the proper officers with the evidence and names of witnesses obtained by him. He shall, when required, report to the commissioner of insurance his proceedings, and the progress in prosecutions for causing fires and the results thereof.

IMPORTANT.—Use Unsprinklered Risk Fire Report Blank (yellow colored paper) when reporting fires in Unsprinklered Risks.

Fire No. Member Reporting	SPRINKLERED FIRE REPORT FOR THE National Fire Protection Association <small>Mail promptly to DEPARTMENT OF FIRE RECORD, 60 Battery March Street, Boston, Mass.</small>	Sprinkler File No. Date Reported
Name of Inspector		<small>NOTE. Underline or scratch the word that properly answers the question, where possible, or otherwise describe.</small>
Name of Risk (and Tenant)	Street	City
Location	State	
Date of fire	Day of week	Time of day
Plant in operation		
Class of risk as a whole	Specific occupancy	
Goods manufactured	Processes	
Room or building in which fire occurred	Which story	Area
Extent of fire. Confined to machine, room, floor, section, building, of origin. Extended to, beyond, adjacent building		
Construction. Height	Sto., bas'm't, attic. Walls: wood, brick, stone, concrete, steel frame, fire resistive. Finish	
Floors: Joist, plank and timber, exposed metal members, fire resistive	Finish	
Floor openings: Open, shut off, cut off stairs; open, shut off, cut off elevators; belt holes, hoists, dumb waiters, chutes, light wells		
Protection against exposure: Walls independent, party; blank, unprotected openings; windows shuttered, wire glass, open spkrs.; held, failed.		
Roofs shingle, slow burn., fire resist.; cornices wood, met.; skylights thin, heavy, wire, glass, not protected; roof houses not combust.; held, failed.		
Alarm service. First notification from watchman, employee, thermostat, sprinkler alarm, supervisory system, fire patrol, policeman, outsider.		
Alarm transmitted by thermostat, spkr. alarm, watchman, employee, outsider, through public fire alarm box, auxiliary box, whistle, telephone.		
Watchman, nights, days when not running	Stationary, portable clock, central station, type	
Rounds	Failed to discover fire	
Sprinkler alarm valve, type	Conn. to rotary gong, thermo. system, cen. sta., fire dept., dwlg., bell at risk. Operated	
Thermostats, type	Conn. to cen. sta., fire dept., dwlg., bell at risk	Operated
Supervisory system, name	Connected to	Operated
Failure of alarm devices (give reasons)		
FIRE CLASSIFICATION. Common hazard, special hazard, exposure, conflagration, incendiary, unknown.		
Cause. Lighting	Heating	Power or transmission
Boiler or fuel		
Chimney or stack	Locomotive sparks	Smoking or matches
Lightning	Rubbish or sweepings	
Oily material (spontaneous ignition)	Storage of inflammables or explosives	
Special hazard (process or machine)		
Miscellaneous		(Give full description of causes on other side.)
Inside protection used (other than spkrs.) Water, sand pails, chem. extgrs., hand, st'd pipe hose, chem. tank, blankets, steam jets.		
Outside protection used. City, town, public, private, volunteer fire department, bucket brigade		
Public hose streams, No.	supplied by low, high service water works, steamers, fire boats, chemical	
Private hose streams, No.	supplied by low, high pressure water works, reservoir, tank, fire pumps	
Sprinklers. Name	Type	When installed
Fusing point		
Number in room	Number opened	Pipes when installed
Pipe sizes		
Spacing and arrangement of sprinklers		
Obstructions to distribution	Condition of heads	Shut off in winter
Wet or dry system. Name and type of dry valve		
Air pressure	Number of sprinklers on dry valve	Operation, satisfactory, slow, unsatisfactory
Reason for failure		
Water supply to sprinklers. Primary supply: Low, high service water works	in. main, pres. lbs.; grav., pres. tank	
gals.; auto., stand., steam, electric	gal. pump; reservoir	gals. Static pres. on spkrs. operating
Secondary supplies for sprinklers. Low, high service water works	in. main, pres. lbs.; grav., pres. tank	gals.; stand., steam, electric, rotary, centrifugal, plunger pump
gals.;	steamer connection	Was the second supply a factor in extinguishing fire?
Amount water used		
Approx. amount used by each supply, pres. maintained (or reduction in pres.) and length of time in service.		
Effect of sprinklers. Entirely, practically, extinguished fire. Held fire in check. Unsatisfactory. Failure		Reason for not extinguishing fire.
Relative loss. None, slight, small, very moderate, moderate, considerable, large, heavy, disastrous, nearly total, total		
Reason for large loss. Sprinkler system out of commission, poor protection, indifferent fighting of fire, poor construction, severe hazard, especially inflammable contents, stock susceptible to smoke and water damage, arrangement of occupancy, poor salvage work.		

This form adopted by the Fire Underwriters' Uniformity Association. (OVER)

Sound value of buildings	Loss on buildings	Insurance loss on buildings
" " " machinery	" " " machinery	" " " machinery
" " " stock	" " " stock	" " " stock
Total value	Total loss	Total insurance loss
Use and Occupancy Insurance.	Total loss	Loss paid
Rent Insurance	Total loss	Loss paid

GENERAL REMARKS.—Please write up full account of fire in narrative form, but cover particularly the following points:—1. Complete details of cause. 2. Extent of fire. 3. Cause of large loss. 4. General construction of plant as a whole. 5. Details of cut offs where a factor: fire walls, fire doors. 6. Details of protection against exposure where a factor: shutters, wire glass windows, open sprinklers. 7. Management. 8. Details of failure in alarm service. 9. How fought. 10. Amount of apparatus used. 11. Action of fire protection devices (especially sprinklers); and reasons for any failure. 12. Wind. 13. Temperature (if unusual, especially if cold). 14. Loss of life. 15. What was done by Assured or Fire Patrol to protect property after fire. 16. Condition of fire appliances (especially sprinkler system) after fire. 17. Lessons of Fire. 18. Recommendations. 19. Make a sketch where appropriate.

(BACK SIDE)

FIGURE 193.
(193)

SECTION 5. Any inspector may, in the performance of the duties imposed by this chapter, at reasonable hours enter upon and examine any building or premises where any fire has occurred, or other buildings or premises adjoining or near the same, with the consent of the occupant thereof.

SECTION 46. (Applies only in Metropolitan Fire Prevention District. For map of this district, see Fig. 243, Chapter 14.) Heads of fire departments within the metropolitan district shall investigate or cause to be investigated the cause, origin and circumstances of every fire occurring in their respective cities, towns or fire districts by which property has been destroyed or damaged, and so far as possible, determine whether the fire was the result of carelessness or design. Such investigation shall be begun immediately upon the occurrence of the fire by the head of the department in whose territory the fire occurred, or by some person designated by him; and if after making such investigation it appears to the head of the department that the fire is of suspicious origin, he shall immediately notify the marshal of the fact. Every fire occurring in the metropolitan district shall be reported in writing to the marshal within three days after the occurrence of the same by the officer in whose jurisdiction the fire occurred. Such report shall be in the form prescribed by the marshal and shall contain a statement of all facts relating to the cause and origin of the fire that can be ascertained, the extent of damage thereof, the insurance upon the property damage, and such other information as may be required.

(SECTION 25 of Chapter 48, General Laws, also empowers investigation of forest fires by a forester in the absence of a local fire department.)

The phraseology of the foregoing sections does not make clear just who is primarily responsible for the investigations of fires. Section 3 expressly requires the investigation of fires in Boston by the state fire marshal. As nearly as can be determined this phrase originated when Boston had a city fire marshal. As city fire marshal this official made an excellent record, and was made fire marshal for the state, he having proven the feasibility of the plan now quite universally employed of having a special officer investigate suspicious fires. As a state official he still took care of Boston and the phrase remained in the law in spite of subsequent revisions which included Section 46, which assigns authority for investigation of fires to the head of the local fire department in the cities and towns of the Metropolitan Fire Prevention District.

It is clear, that elsewhere than in Boston, the fire departments of Massachusetts cities and towns are to investigate their fires, notifying the state fire marshal when circumstances suggest incendiarism.

Lack of Cooperation Between State and City Departments. The marshal has provided a staff of several men to cover Boston whose duty it is to investigate all suspicious fires. The number provided (4 in all) should be ample to investigate any such fires reported to them.

In 1924 or thereabouts, the Boston Fire Department assigned a man to investigate fires. This special investigator had apparently been functioning for two years, when the State Fire Marshal in a letter to the chief of the Boston Fire Department in March, 1926, claimed that this investigator was embarrassing the men of the Department of Public Safety in their work. The main complaint was that the fire department's representative got to fires before the state men and started inquiries which were prejudicial to subsequent investigations by the Department of Public Safety. The marshal stated that this investigator was operating contrary to law and requested that his activities cease.

The present administration of the Fire Department has followed the policy of helping the state authorities in every way possible in arson cases. Fire alarm headquarters, immediately upon receipt of word from the district chief at the fire that the fire has suspicious aspects calls the Department of Public Safety, where the fact is reported to the officer on duty there day and night, who may immediately notify the state inspectors. In addition, a detail has been left at every fire a reasonable time, or until the representative of the Department of Public Safety arrives. This is to prevent tampering with the premises which might destroy evidence valuable in arson cases and to keep unauthorized persons away. This practice was started in the fall of 1926. Correspondence between the marshal and the Fire Commissioner shows that this practice was resented by the fire marshal's office.

It would, perhaps, matter little whether the state or city made the actual investigations of fires if there was adequate cooperation. The local department, however, has one important advantage in that it can get its investigators to the fire much quicker than those of any other agency.

The reports of the Fire Department details at suspicious fires during the first six months of 1927 showed that the state inspectors ordinarily arrived at a fire sometime during the forenoon of the day following the fire. In a few cases the response was more prompt than that, but in several the report of the detail showed no record of the arrival of a state inspector up to the time the detail was dismissed.

The statistical analysis of Boston's fire record (Fig. 126, Chapter 6) shows that in 1925 and again in 1926 there was a peak of losses at about the same time each year that corresponded exactly to a marked slump in business conditions. Even

without the statistical data, the city authorities could see that arson was playing a large part in making the fire loss of Boston so high, and that whatever the reason, the procedure in effect for control was not stopping it. Accordingly a police officer was assigned to the Fire Department from the Police Department. That officer has made a practice of getting to suspicious fires promptly and making such investigations as he can before the state men arrive, allowing them on arrival to take charge of the case.

TABLE 196

HOW FIRES REPORTED AS SUSPICIOUS BY THE BOSTON FIRE DEPARTMENT WERE DISPOSED OF BY THE STATE DEPARTMENT OF PUBLIC SAFETY

Compiled from data furnished by State Fire Marshal

	1926	1927	1928
Fires for which Convictions Were Obtained.....	1	7	8
Defendant Held "Not Guilty".....	3	5	9
Cases Given "No Bill".....	4	17	2
Cases Pending.....	0	0	2
Total Cases Prosecuted by Marshal's Office.....	8	29	21
Cases where Evidence Was Insufficient for Prosecution.....	¹ 1	² 9	
Total Fires Considered Incendiary by Marshal.....	9	38	(³ 35)
CAUSES ASSIGNED BY MARSHAL TO FIRES OTHERWISE DISPOSED OF:			
Detailed Data not Furnished by Marshal.....			83
Cause "Unknown — Suspicious".....	3	34	
Cause "Unknown".....	7	8	
Believed to be Set by Boys.....	1	8	
Miscellaneous Known Causes.....	8	9	
Fires of which the Marshal Had No Record.....	3	6	
Total Fires Reported Suspicious by Boston Fire Department.....	31	103	104

¹ Fire set by insane man.

² One fire maliciously set by boys.

³ Figure from annual report of Division of Fire Prevention, Department of Public Safety.

Fires Reported as Suspicious. On being furnished with a list of the fires reported as suspicious by the Fire Department during 1926, 1927 and 1928, the state fire marshal's office had the files for those years examined and the disposition of each of the fires noted on the list. This data has been

summarized in Table 196. For 1928 the marshal did not furnish data as to the disposition of reported fires other than those prosecuted, so no detailed analysis of these latter fires can be made. They are, however, reported in detail in 1926 and 1927.

It will be noted from Table 196 (and the first column of Table 198 A) that the Fire Department reported some three times as many fires in 1927 and 1928 as had been its practice. This was the result of an order of the Fire Commissioner that fire officers assign a cause of every fire. It may appear at first glance that the Fire Department "was over-zealous" in reporting fires as suspicious but after investigation of the 103 fires so reported in 1927, the Department of Public Safety definitely determined 38 to be incendiary, 34 to be "unknown — suspicious" and 8 "set by boys," showing that in 80 of the 103 fires the Department of Public Safety agreed with the Fire Department's reports that the fires were incendiary or suspicious. Similar figures are not available for 1928, but the number of fires determined as incendiary by the Department of Public Safety shows a much higher figure in both 1927 and 1928 than in years previous. (See second column of Table 198 B.) Although the assistant fire marshal observed that of the 38 fires in 1927 more than a dozen were the work of one man, nevertheless the number of fires determined to be incendiary in that year was above normal.

Fig. 126 of Chapter 6 reveals marked peaks in fire losses in 1925, 1926 and 1928, corresponding to depressions in the index curve of business conditions. The peak in 1927 is less marked indicating that the losses had moved upward as in the other three years, but had been retarded by some influence, possibly the greater activity of the Fire Department in reporting and investigating fires. While the losses of 1928 did reach a peak corresponding to the business depression of that year, the loss curve stayed nearly normal instead of mounting as in the four years preceding 1927.

As to the number of convictions for arson the fire marshal was only able to provide the figures given in Table 196 for 1926, 1927 and 1928. For figures for each of the last 10 years the returns of criminal cases in the various courts having jurisdiction in Boston, as on file at the State Department of Correction, were consulted. The number of prosecutions and convictions thus obtained are presented in Table 198 (B), from which they were summarized and shown in the last two columns of Table 198 (A). While the figures for 1926, 1927 and 1928 apparently do not check, the differences may be largely accounted for. The court returns are on the basis of court years which run from October to October, while the fire marshal's figures are for the calendar year. Also the marshal's figures are given on the basis of the number of fires for which prosecutions or convictions were obtained, and it is known that in several cases single individuals were prosecuted and convicted for a number of fires.

TABLE 198
(A) ACTIVITY IN PROSECUTING ARSON IN BOSTON, 1919-1928

YEAR	Fires Reported as Incendiary or Suspicious by Boston Fire Department ¹	Fires Determined to be Incendiary by the State Department of Public Safety ²	Number of Prosecutions ³	Number of Convictions ³
1919.....	18	6	—	—
1920.....	14	7	11	10
1921.....	33	2	24	19
1922.....	18	9	4	0
1923.....	27	7	1	0
1924.....	46	⁴ 17	14	2
1925.....	28	7	7	3
1926.....	31	9	2	2
1927.....	103	38	7	1
1928.....	104	35	9	4

¹ From annual reports of Boston Fire Department.

² From annual report of Division of Fire Prevention of State Department of Public Safety (State Fire Marshal).

³ From Returns and Records of court cases on file at State Department of Correction. (Court years run from October to October.)

⁴ A majority of these fires were set by one pyromaniac.

(B). PROSECUTIONS AND CONVICTIONS FOR ARSON OR THE BURNING OF BUILDINGS IN
BOSTON, 1919-1928

YEAR ¹	LOWER COURTS ²		SUPERIOR COURT ³		TOTAL	
	Prosecutions	Convictions	Prosecutions	Convictions	Prosecutions	Convictions
1919 ⁴	—	—	—	—	—	—
1920.....	0	0	11	10	11	10
1921.....	9	7	15	12	24	19
1922.....	3	0	1	0	4	0
1923.....	0	0	1	0	1	0
1924.....	7	2	7	0	14	2
1925.....	2	1	5	2	7	3
1926.....	2	2	0	0	2	2
1927.....	2	0	5	1	7	1
1928.....	5	3	4	1	9	4

¹ Year runs from October to October.

² From Returns of Criminal Cases before Municipal, Police and District Courts and Trial Justices.

³ From Report of Criminal Cases in Superior Court for Suffolk County.

⁴ No Returns on file.

As observed in Chapter 6, during practically every year of the series, when business declined, losses rose, and *vice versa*. None of the accompanying statistical data indicates that the present facilities for the prosecution of arson are having any material effect. The only hopeful sign is that in the last four or five years there is a downward *trend* of losses coincident with a downward trend of business conditions, and that in 1927, when the local authorities increased their activities, losses did not show as great a response to poor business conditions as usual.

Importance of Cooperation in Securing Convictions for Arson.

The following conditions are preventing adequate control of arson in Boston:

1. The general investigation of fires is superficial and does not tend to reveal suspicious circumstances so that the proportion of incendiary fires investigated is likely to be small.

2. Until recently no real attempt has been made to have suspicious fires promptly reported by district chiefs of the Fire Department. The evidence of such district officers should be used to the fullest extent in arson prosecutions.

3. The efforts of the local "arson squad," made up of a police officer and Fire Department inspector, are limited because of a lack of authority.

4. The state authorities have shown reluctance to take full advantage of local cooperation.

The lack of a coordinated and determined attack on the incendiary is acute. Experience in all parts of the country has demonstrated that casual investigation of fires and prosecutions for arson is futile. It is essential that arson investigation be handled by the local fire departments. This is true of Boston. The local "arson squad" can get to fires quicker than state inspectors and can secure the interested cooperation of the rank and file of the Fire Department much better than a state agency. Such investigation has proven effective in other large cities, of which Detroit is a conspicuous example.

THE ARSON STATUTES

Convictions for arson are difficult to secure, even with the best of facilities, because fires so often destroy necessary evidence. Arson cases must be prepared with unusual care to prevent the defendant escaping conviction through some loophole in the law. Massachusetts statutes leave such loopholes. (See Appendix 11 A.)

In general the Massachusetts statutes do not designate as arson the burning of one's own property. Conviction is possible for burning to defraud an insurance company, but convictions of this kind are notoriously difficult to obtain. As a practical thing, the statute making burning to defraud a felony is of little

value. The law should designate arson as the deliberate and malicious burning of any property, whether one's own or another's, without reference to fire insurance. Such an act is criminal because experience of conflagrations has shown that once a fire is started its spread may not be accurately foretold.

The Massachusetts statutes are also weak in that they do not place in the same category as the incendiary persons who aid, counsel or procure the commission of the crime. This makes conviction of incendiaries difficult, for at present it is almost impossible to secure a conviction unless the defendant confesses or is seen setting the fire. Attempts to commit the crime, where the person may be apprehended before actually setting the fire, are fairly well covered by General Laws (Sections 1, 2, 3 and 6 of Chapter 274, General Laws) relating to attempts to commit any crime.

The penalties for arson provided in the present law are somewhat too severe and serve to make juries reluctant to convict.

CONCLUSIONS AND RECOMMENDATIONS

1. It is recommended that in the technical division of the Fire Department, recommended in a previous chapter, there be at least two competent engineers assigned to the investigation of fires, so as to provide data concerning the action of fires in relation to construction, protection, and prevention details.

2. It is recommended that the two men now provided by the Fire and Police Departments of Boston be officially organized as an arson squad, and that the State Department of Public Safety give them the necessary authority to make such investigations. The Commissioner of Public Safety under Section 4 of the General Laws can designate the two Boston men as fire investigators.

3. It is further recommended that in Section 3 of Chapter 148, General Laws, the words "the marshal in Boston" be stricken out in order that the thought that the State Fire Marshal should have more authority in Boston than elsewhere be dissipated. Under Chapter 148 the marshal has ample powers without this clause to operate in Boston or any other city where he finds that the local authorities are not functioning properly.

4. It is recommended that the arson statutes be amended to conform to the Model Arson Law, recommended by the Fire Marshals' Section of the National Fire Protection Association, which law is already in force and effective operation in 27 states. (See Appendix 11 B.)

CHAPTER 12

FIRE PREVENTION INSPECTIONS

There are numerous agencies doing work that would come under the heading of fire prevention inspections. The principal ones are the following:

1. The Fire Department.
2. The State Department of Public Safety.
3. The City Building Department.
4. Insurance inspection agencies.

Insurance agencies include the Boston Board of Fire Underwriters and the Eastern Underwriters' Association Inspection Bureau for the stock companies, and several mutual company inspection bureaus.

THE BOSTON BUILDING DEPARTMENT

The administrative force consists of a commissioner and twenty assistants. The operating force is divided as follows, including chiefs of the division:

Division	Number of Men.
Plan Division	10
Construction Division	20
Egress Division	9
Sprinkler Division	3
Zoning Division	3
Elevator Division	12
Plumbing Division	12
Gas Fitting Division	12
Board of Appeal	6
Board of Examiners	4

The work of the various divisions is indicated by their titles. For administrative purposes the city is divided into districts with an inspector in each. It is not a practice to move inspectors about from one district to another. Occasionally transfers are made, but they are the exception.

New Buildings. The applicant for a permit to erect a new building submits a brief of the proposed work, together with two complete sets of plans. The brief goes to the inspector in whose district the new building is to be erected. He views the premises within forty-eight hours and signifies his approval or gives a memorandum with his disapproval. The plans and application then

come together in the department and are sent to the Plan Division. The plans are there examined for all features covered by the code. The plans are finally approved or not approved as conditions warrant. If the applicant so desires in the case of a "not approved" set of plans he may request a "formal refusal," to which he may answer with a "formal appeal," which goes to a Board of Appeal provided by the building code and is either sustained or rejected. After necessary corrections are made, formal approval is stamped on the plans and one set is returned to the applicant, who is required to keep this set on the job for review by the city inspector at all times. The inspector then visits the work as often as his schedule permits.

The approval by the inspectors of plumbing, gas fitting, fire-stopping and similar features must be obtained before the lath and plastering work is begun. When the construction is completed, the inspector either gives his approval or files a complaint. These complaints are considered by the Commissioner and his staff and prosecution is resorted to if the complaint is serious enough.

Old Buildings. There is no systematic inspection of old buildings by the Building Department. It does as much of this work as is possible with the present force, but the department is dependent upon the other inspection agencies in the city to keep it informed on conditions in old buildings, supplemented by information furnished almost daily through complaints from interested citizens. The procedure followed on information furnished by the Fire Department inspectors will probably best illustrate the method of handling reported defects in old buildings.

Whenever notice of a defect is received from the Fire Department, a letter is sent to the owner of the building in question stating the defects as noted. A copy of this letter is given to the building inspector of the district, who visits the premises and reviews the conditions the Fire Department reports. If the building inspector confirms the Fire Department's report a complaint is issued to the owner of the building. The Building Department inspectors sustain the Fire Department in all matters where the code permits them to do so. The Building Commissioner has wide discretionary powers in regard to old buildings, but because the provisions for old buildings are not written into the code, the field inspectors have nothing to back up their decisions. If owners do not comply with such complaints as are issued the matter may be passed on to the Commissioner and his staff who then decide whether prosecution is possible. The percentage of prosecutions is, however, small.

THE STATE DEPARTMENT OF PUBLIC SAFETY

While it is provided that the local Building and Fire Departments shall handle inspection matters, nevertheless the State Department of Public Safety

assigns a part of its staff to work in Boston. Matters of motion picture projection, garages, and elevators are primarily looked after by the local Building Department. Appeals from the decisions of the Boston Building Department on these matters however go to the Division of Inspections of the Department of Public Safety. A number of inspectors of that division are accordingly assigned to handle such appeals.

The inspection of high-pressure boilers is handled entirely by special state boiler inspectors operating under the Division of Inspection.

Four men of the Fire Prevention Division of the Department of Public Safety are assigned to fire prevention inspection work on cases referred to the State Fire Marshal by the local Fire Department. These men also investigate fires in Boston.

INSURANCE ORGANIZATIONS

The Boston Board of Fire Underwriters inspects buildings for the purpose of fire insurance rating and also inspects installations of automatic sprinklers. The Eastern Underwriters' Inspection Bureau inspects and makes reports for underwriting purposes for the fire insurance companies in the Bureau. Fire prevention engineers of insurance agents and brokers, and also special agents of insurance companies, make inspections of particular properties.

These inspections provide information concerning any defects in properties and do much to educate the property owner in fire prevention.

More than passing comment should be made regarding the activities of the Boston Board of Fire Underwriters, as it is the insurance organization performing the major part of fire prevention work in the city.

The staff includes a number of qualified engineers, whose cooperation and advice may well be sought by individuals and municipal departments. The Board is very willing to cooperate in every way toward reducing the fire loss in the city, and has in the past contributed valuable assistance to various municipal departments in working out good fire protection engineering practices.

Such recommendations as fire insurance organizations make are necessarily advisory, as they have no legal authority to require improvements. Their suggestions are accepted for obtaining a particular rate or as a condition stipulated for the acceptance of the property as a risk. There is nothing an insurance company can do which will prevent an owner from maintaining a fire hazard if he is willing to pay for it in his rate. High rates for hazardous occupancies are not always sufficient incentive for the correction of fire-breeding conditions.

Large individual properties, such as industrial plants, are subject to very thorough and competent inspection by stock or mutual insurance groups. Such properties are usually completely sprinklered and in any case have private fire protection in the form of private water supplies, fire brigades, standpipes, first-aid fire appliances, fire alarm, watchman service, etc. The losses in this type of

property are commonly small in proportion to the values present. They indicate what can be accomplished by fire protection and suggest that if similar supervision and inspection can be provided the losses can be similarly reduced in other properties.

It is in the insurance field that practically all of the best present fire protection and fire prevention technique has been developed and it is high time that agencies like fire departments put this available knowledge to use.

FIRE DEPARTMENT INSPECTION WORK

Although far from adequate, the Fire Department is the only agency that provides a systematic inspection for all property in the city. Fire Department inspections are made both by regular fire officers and by the Division of Fire Prevention. Electric wiring is inspected by the Wire Division.

Inspection by Company Officers. Building inspection by company officers is mainly for the purpose of acquainting them with the buildings in their districts, so that in case of fire, extinguishing operations may be more intelligently directed. A better knowledge by district chiefs concerning some of the buildings in their districts would be helpful. This suggestion refers to the most advantageous means of entrance in order to quickly get at the seat of a fire, to detailed knowledge of buildings that are sprinklered, location of control valves for sprinkler systems, and to general knowledge of building construction so that fire fighting can be intelligently planned in an emergency.

Inspections, for the purpose of checking up the abatement notices issued by the Fire Prevention Division, are also made by the various company officers. (See Inspection Procedure.)

Inspections by the Fire Prevention Division. On this division falls the responsibility for much of the inspection work of the department. It is directed by a deputy chief as acting superintendent, who is thoroughly familiar with fire hazard conditions, and consists of the personnel given in the accompanying table:

PERSONNEL OF FIRE PREVENTION DIVISION	Number of Men
Field Inspectors	24
Uniformed Office Force	6
Civilian Office Force	5
Police Officer	1
Special Investigator	1
Constable	1
Chief's Chauffeur	1
Janitor	1
Total Number of Men ¹	40

¹ As of February, 1929. The bureau staff has since been increased.

On this division of the Fire Department approximately \$90,000 a year is spent out of about \$4,350,000, the sum spent upon the entire department. In other words, only 2 per cent. of the budget is spent to prevent fires, while 98 per cent. is spent in fighting them after they start. It would obviously not be unreasonable to devote a larger portion of the budget to fire prevention.

Inspection Procedure. After an inspection has been made the owner is sent an "abatement" notice if defects are found, asking for their correction. If some of the defects involve matters which are under the authority of the State Fire Marshal a copy is sent to that office. If certain defects come under the jurisdiction of the Building Department, that department is notified. Copies of the abatement notices are sent to the various district chiefs, who in turn apportion them to the various company officers for attention. Where owners do not correct defects, two further notices or orders may be served before legal steps are taken by the Fire Prevention Division if the case falls under their authority. Cases over which the fire marshal, Building Department or other agency has jurisdiction are referred to those agencies for prosecution.

Character of the Inspections. Present inspections may be relied upon only to unearth the commoner and more apparent fire hazards, such as rubbish, simple defects of heating apparatus and the like. The men assigned to inspection work are regular firemen, some of them slightly disabled, who have the limitations of education and training already described. (Chapter 7.)

In spite of the rudimentary character of the present inspection work, its value is considerable, as the commonest hazards are thereby found and corrected. Such inspections do much to cut down the *frequency* of fires even though many serious "special" fire hazards are not recognized. By "special hazard" is meant manufacturing processes using flammable liquids, hazardous chemicals, or fibrous or dusty materials subject to flash fires or explosion. Here is definite need for the assistance of the men which the proposed technical division of the Fire Department would provide.

CONDITIONS FOUND BY INSPECTIONS

In making inspections of typical parts of the city for the purposes of this report the staff engineers were accompanied by inspectors of the Fire Prevention Division of the Fire Department. The latter were received courteously by practically all property owners indicating that inspectors of the Fire Prevention Division have handled their contacts with the public well in the past and that consequently there is no ill feeling.

Conditions of cleanliness and neatness, particularly in the smaller properties, were not good, and would indicate that inspection is not frequent enough.

Wharf District. There is apparently heavy loading of the floors of old brick, wood-joist buildings in both the wharf and market districts. In many cases merchandise was found piled to ceilings, and doors and window openings were substantially blocked which would greatly hamper attack on fires in these buildings. More rigid enforcement of the requirement for the storage of flammable liquids in safety cans is evidently necessary. While nearly every building in this district contains some sort of fire extinguisher or pail, very little instruction in the maintenance of this equipment has been given, as the water in fire pails was frequently found frozen and extinguishers which should be kept in heated places were exposed to freezing temperatures.

Market District. Buildings in this district frequently had open shafts which would allow fire to spread rapidly. Rubbish was found under several stairways. Extinguishers were generally lacking and fire pails were frequently found empty. A defectively installed oil burner was found. In a spring bed factory were two dip tanks of flammable liquid with no first-aid fire appliances provided for protection. As in the wharf district the storage of stock occasionally blocked windows and doors.

Wholesale Mercantile District. Maintenance in the block inspected was relatively good, except that a few accumulations of rubbish were found. Most of these buildings are sprinklered which reduces the potential fire hazard.

Theater and Retail District. Maintenance conditions throughout this district were generally good. In the theaters extinguishers were provided and were well maintained.

Manufacturing Districts. (a) **TENANT MANUFACTURING.** In several of the smaller tenant manufacturing plants inspected housekeeping was very poor. In others it was fairly good. In one place a substandard paint spraying booth was found in very dirty condition with the water pails provided for protection empty. This booth is a very bad hazard, but no one had apparently told the owner about it. In a group of tenant woodworkers fire doors were found blocked open which made them worthless to prevent the spread of fire from one part of the building to another. Another substandard spray booth was found in these occupancies, and in one or two cases sprinklers were found obstructed by plaster models hanging from the ceiling. Boiler rooms and shaving chutes were very badly arranged and constituted an abnormally bad hazard. Part of an otherwise sprinklered building was found unsprinklered.

(b) **SINGLE TENANT PROPERTIES.** A furniture manufacturing plant was found in generally good condition, except for a paint storage room and a substandard spraying room on the top floor, an obstructed fire door and unsatisfactory

conditions in the boiler room. An attempt to put the paint storage and the spraying section of the building in order had obviously been made, but conditions fell short of the minimum requirements for reasonable safety. While part of this woodworking plant was sprinklered, certain parts devoted to storage were not sprinklered. Unsprinklered portions in which fire may get a start are a menace to the integrity of sprinkler protection.

One large brass foundry was found in excellent condition, its paint spraying booths and other special hazards being well protected, showing that it was under the supervision of some competent insurance inspection agency. The plant offered practically no serious hazard.



A view showing back yards in a West End tenement district. These are typical of back yards in the North and South Ends as well. The fences and sheds are serious obstructions in case of fire. The importance of inspection work in these districts is demonstrated not only by these obvious hazards, but by the high fire frequency here as well.

Tenement Districts, West, North and South Ends. The districts inspected were those which had shown a high frequency of fire and considerable losses. The reason for these fires and losses was readily apparent in the rubbish found and the defective chimney and heating arrangements alone. The closely built condition of the buildings, the back yards enclosed by high wooden fences, and the rubbish accumulations and wooden sheds in these yards all induce fires.

Open flue holes were found in many cases; defective smoke pipes and defectively installed stoves were common. An oil burner and gas burner in a store and an enameling furnace in a small manufacturing property, together with a stove mounted on three legs, were typical defective installations of heating apparatus noted in the West, North and South Ends. It is apparent that inspections have not been frequent enough in these districts to keep conditions satisfactory.

Most of the fire escapes provided were rendered of slight value because of obstructions in the form of boxes, tubs and other obstacles placed on them. This was especially true of balconies extending between adjacent tenement houses as horizontal exits. In several cases the cantilever sections of fire escapes were found to be inoperative, one of them being obstructed by a sign. Many of the fire escapes had no section from the second floor to the street, and in other cases terminated in the back yards of the tenements from which egress would be very difficult. In general these fire escapes are worthless. In practically all cases they pass by plain glass windows which would make the escapes useless in case of a fire in the rooms by which they pass. Plaster off ceilings in some cases would increase the speed with which fire could spread. Obsolete electric wiring was noted in a number of cases. In only a few cases were extinguishers or fire pails provided in the stores which occupy the first floors of most of these tenements.

Brick and Frame Apartments in Outlying Districts of City. Heating units have apparently received good attention as in brick apartments and "three deckers" the majority of these were found well arranged. Rubbish accumulations have also been fairly well looked after, although ashes were poorly taken care of in some of the apartments. Very little attention has apparently been paid by the Fire or Building Departments to matters of fire stopping around switchboards, soil pipes or drains from ice chests, at which places plastering was frequently found broken away, a condition which would rapidly spread fire from the basement to the upper floors. In addition many of the stairs to the basement of apartments are not provided with doors or enclosures. Fires may spread very rapidly up such stairways. See Fig. 81.

"INSPECTION PATROL" PLAN

The spot maps of fires in Chapter 4 show the areas where fires are most frequent and losses heaviest. From these maps, Figs. 209 and 211, maps of districts recommended for inspection have been prepared. It is therefore suggested that in these districts the frequency of inspections be increased.

Other parts of the city can be covered as at present, about twice a year. The bad districts should be covered if possible twice a month.



FIGURE 209.

It is recommended that a staff of inspectors be developed in order to cover the city substantially as follows:

TO COVER BAD BLOCKS ONLY.		Number of Inspectors
District 1.—	East Boston	1
District 2.—	Charlestown	2
District 3.—	General Wholesale District	2
District 4.—	Market District, North and West Ends, Manufacturing and Warehouse District and part of Retail District	12
District 5.—	Retail and part of Wholesale District	5
District 6.—	South Boston	2
District 7.—	Back Bay and South End	6
District 8.—	Roxbury and Fenway	4
District 9.—	Dorchester	2
District 10.—	Dorchester	2
District 11.—	Brighton	1
District 12.—	Jamaica Plain	1
Districts 13, 14 and 15.—	Dorchester, Hyde Park and West Roxbury	2
		<hr/> 42
To cover rest of city as now covered		12
		<hr/> 54
Total inspection staff other than technical division		54
Present Inspection force		¹ 24
		<hr/> 30
Additional Inspectors needed		30

It is not suggested that inspectors be assigned to any given district. They should be moved about so that they will not return to a district until they have covered all the others. The plan of rotation will stimulate thoroughness as one inspector will check up another.

The exact blocks to be inspected are shown in Fig. 209. For the downtown blocks a large scale map (Fig. 211) is given to identify these areas more clearly.

Inspection by Technical Staff. In connection with this inspection “patrol” plan, the staff of the proposed technical division of the Fire Department will be expected to lay out new inspection districts from time to time and generally plan the inspection work. The districts to be inspected can be determined as here demonstrated, by the preparation of spot maps. By spotting fires from day to day as they occur these maps can quickly indicate just where inspections can be most profitably made. It is obvious that fire areas may change somewhat from time to time and these proposed inspection districts need revision.

¹ As of February, 1929. The number of inspectors has been increased since.



FIGURE 211.
(211)

Another function of the technical division will be to classify fire losses by occupancy and to follow business conditions in the major business groups, like leather, clothing, and others. Whenever conditions are known to be bad in a given line of business, the technical staff can designate what business houses are to be inspected more frequently than usual.

A third function will be for the technicians to supervise and, where necessary, themselves make inspections of special hazards. The technical aspects of the regulations on fire prevention (Chapter 13) show why technical men who understand the hazards involved must be assigned to the enforcement of such regulations. A minimum of two technically trained men should be assigned to this work and they should so plan their work so as to inspect the major "special" hazards in the city at least once a year. This may be done by requiring the regular inspectors to report such hazards where they exist.

Training of Inspectors. A fourth function of the proposed technical staff will be to train the inspectors of the Fire Prevention Division. A weekly session of all inspectors should be held and instruction given. Such instruction should cover first, the recognition of fire hazards and proper methods of safeguarding them. Second, it should cover the laws and regulations empowering the Fire Department to require the elimination and correction of hazards. Third, it should cover inspection methods and procedure.

At present there is no provision for systematic training of this character. Field inspections indicated that special hazards remain unrecognized by the inspectors. Members of the Fire Prevention Division showed scanty knowledge of the procedure necessary in particular instances to correct hazardous conditions. This is in part due to confusion in the law but it would certainly help the inspectors if they might be instructed in these matters. The present force of inspectors has been making a good impression on the public, but if new men are added these will need instruction in how to approach property owners when making inspections. New inspectors must be impressed with the need for such things as neat appearance, courteous manners and general consideration for the people in the properties inspected.

A More Detailed Inspection Blank. The proposed technical staff should develop an inspection blank suited to local conditions. This should give the inspectors a check list of the items they should look for and stimulate a thorough covering of the entire property. A blank used in Detroit is illustrated herewith (Fig. 213). It will be noted that this provides a fairly comprehensive report on the fire protection in the building, and the column at the left gives a check list of common violations of specific ordinances which the inspectors are expected to report.

only a simple form, whereas industrial or mercantile buildings would need a more complicated and detailed form to properly report all details of the inspections.

Wire Division. The details of organization, personnel, inspections, records, laws and regulations, inside and outside work, and other matters which pertain to the operation of this department are contained in the National Board of Fire Underwriters' Report No. 158, October, 1925.

According to the fire record, defective electric wiring has not appeared as the cause of any excessive number of fires in Boston. Defective service wiring has caused several serious fires, but the electric companies are correcting these defects. There is, however, much old wiring throughout the city which should receive inspection more frequently. It is recommended that a systematic reinspection of old wiring be made so that all defects may be corrected, and that all wiring shall be subsequently reinspected at suitable intervals.

RECOMMENDATIONS

Building Department. Assign a portion of the building department staff to the inspection of old buildings, increasing the staff if necessary to permit such assignment. These inspectors should, under the direction of the Building Commissioner, make full use of his discretionary powers in ordering improvements.

State Department of Public Safety. This department through the State Fire Marshal, or his assistants, should cooperate closely with the fire prevention division of the Boston Fire Department and provide that division with information about the state laws and regulations. In matters that must be handled by the state it should expedite action to the end that enforcement may be prompt and effective.

Inspections by Fire Department Officers. 1. District chiefs and company officers should continue to make regular inspections of their district as at present.

2. District chiefs should keep records of inspections in such form as to be readily accessible covering the essential features of the more important buildings in their districts. Such records should include any special fire hazards of occupancy, location of stairs, elevators and other openings, peculiar characteristics of construction and all other information which would be of value in case of fire.

3. Training for district chiefs and company officers should be provided in the "fire college" covering inspection procedure, recognition of fire hazards and other matters of fire prevention. Every private, before promotion to lieutenant, should be required to serve at least a year as an inspector in the fire prevention division.

Inspection by the Fire Prevention Division. 1. Thirty new inspectors should be added to the staff of the fire prevention division.

2. Of the staff of 54 inspectors thus formed 42 should be assigned to "inspection patrol" in the districts illustrated in Figs. 209 and 211. They should inspect every building in the designated inspection areas not less than once a month and preferably once every two weeks.

3. The remaining 12 inspectors should systematically cover the parts of the city not included in the proposed inspection districts after the manner now followed of putting the entire 12 men into each fire district in sequence until the entire city has been covered.

Functions for the Proposed Technical Division. 1. This division should provide a staff with at least two men who can devote their entire time to inspections of special hazards and to supervising such inspection of these hazards as may be delegated to the regular inspection force.

2. This division should provide for the training of the regular inspectors and the new inspection force herein recommended. This training should include instruction as to fire hazards and their correction, procedure under the laws, and general inspection practice.

3. This division should plan inspection work through study of the fire record, design suitable systems to record inspections and provide for their follow-up, and develop suitable inspection blanks for use by the division of fire prevention and company officers.

Wire Division. It is recommended that a systematic reinspection of old wiring be made and defects corrected, and all wiring subsequently reinspected at suitable intervals.

Periodic Inspection Conferences. The heads of each of the various inspection agencies should get together at least four times a year to discuss ways and means to best attack the fire hazards in the city. Such conferences should include the Fire Commissioner, the Chief of the Fire Department, the Superintendent of the Fire Prevention Division and the Superintendent of the proposed Technical Division, the Building Commissioner, the State Fire Marshal, the chief engineer of the Boston Board of Fire Underwriters, the managers of the Eastern Underwriter's Inspection Bureau and heads of such of the mutual insurance bureaus as may be interested.

These periodical conferences will tend to coordinate inspection work in the city, develop cooperative action among the agencies, and make it possible to plan a concerted attack on particular fire hazards from time to time as may seem desirable.

CHAPTER 13

A TECHNICAL ANALYSIS OF FIRE PREVENTION LAWS AND REGULATIONS APPLYING IN BOSTON

The control of fire hazards affecting public safety is universally recognized as coming within the "police power" and as such is subject to regulation by state and municipal governments.

It is customary to cover some matters of fire prevention and fire protection by state law or regulations; others are covered by city ordinances or regulations, depending upon the character of the hazard and the division of authority between state and city government. Such laws or regulations do not aim to secure 100 per cent. fire-safety. They aim rather to make minimum requirements consistent with reasonable public safety.

In Boston these matters are partially covered by a number of laws and regulations, promulgated at various times. Due to lack of codification, and division of jurisdiction between state and city authorities, these laws and regulations are confusing and lose much of their potential value by reason of difficulty on the part of the public in ascertaining the exact provisions applying to any given hazard. The same factors tend to retard and delay their proper enforcement.

Some fire prevention matters in Boston are covered directly by state law, some by regulations issued by the State Fire Marshal, Department of Public Safety, under authority of state laws, others through the Building Code of the City of Boston, and a few others by regulations of other authorities. In Appendix 13 an attempt has been made to list the sections of law authorizing the regulation of fire prevention matters discussed in this chapter. Appendix 15 contains a digest of most of the laws applying. Chapter 148, the Chapter of General Law on Fire Prevention is included in Appendix 14.

The provision of law which outlines only the general principle of the subject treated, leaving to an appropriate authority the responsibility of drafting detailed regulations to carry out the spirit of the law, is an excellent method. This method, which is embodied in much of the Massachusetts legislation on matters of fire hazard (Chapter 148 for example), places the drafting of requirements in the hands of officials who are supposed to be specialists rather than in the hands of general legislative bodies which are seldom qualified to pass upon technical details. The regulation method also has the advantage of permitting modifications from time to time as necessitated by changes in manufacturing processes and hazards,

or indicated as desirable by experience, without the delay and inconvenience inherent in securing action by a general legislative body. These advantages however can only be enjoyed when there is a competent local authority actively carrying out the provisions of the law.

In the following pages of this chapter an analysis is made of the requirements on fire prevention and fire protection applying in the City of Boston. As a basis of comparison the regulations of the National Fire Protection Association are referred to as evidence of the best current practice; the recommendations of other national bodies, where applicable, and the general practices of other cities have also been given due consideration as a background for the analysis. No attempt has been made to make an exhaustive study of the requirements applying in Boston, as to do so would be beyond the scope of this survey. The purpose rather is to indicate in general terms character, completeness, and timeliness, discussing details merely for purposes of illustration. The chapter is limited to matters on which there are published requirements, no attempt having been made to discuss in detail the various matters where no printed regulations apply but where the authorities have power to order correction of individual hazardous conditions in specific instances at their discretion. Some matters are perhaps best handled in this way, but in the absence of documentary evidence, no attempt has been made to survey the adequacy of such handling. Likewise the scope of this chapter does not include any investigation of the competency of enforcement of the various laws and regulations.

The accompanying table gives a list of topics properly the subject of fire-safety regulations, together with an approximate estimate of the adequacy of their treatment in regulations applying to Boston, made in accordance with the general considerations outlined above. It should be noted in this connection that there are a number of subjects where the State Fire Marshal is authorized by law to promulgate regulations on various subjects, but where no such regulations are now extant. With few exceptions, existing legislation broadly construed would give the necessary authority for appropriate regulations on the several important subjects not now covered. (See Appendix 13.) Where there are laws or regulations applying, these have been listed as far as practicable. This list is intended as typical rather than exhaustive, and might be revised in some details if a more comprehensive study were made, but is considered sufficiently complete for the purposes of this chapter. It should be noted that only general subject captions are given, no attempt being made to list matters of relatively minor importance. These necessary limitations in the scope of this chapter should not affect the validity of the general conclusions to be drawn from the analyses made in it. The various divisions of the table are discussed in subsequent paragraphs.

TABLE OF STATE AND CITY REGULATIONS ON FIRE HAZARDS AND FIRE PROTECTION
APPLYING TO BOSTON

KEY TO RATINGS

Note.— These ratings are based solely on judgment, are necessarily only approximate and may be subject to some differences of opinion.

A — Adequate. Cover subject in substantial accordance with best current practice. (Not necessarily 100 per cent. satisfactory.)

F — Fair. Cover subject in a fairly comprehensive manner, but out of line with best current practice, and deficient in important details.

P — Poor or Partial. Cover subject in an inadequate manner, either due to general deficiency, or due to treatment of only portions of subject. (In this case some individual details may be excellently treated, but owing to omission of important matters the general rating is poor.)

N — No Regulations. This class designates those subjects which are not covered by published regulations, even though state or city officers may exercise authority to control individual hazards of the class in question.

Topics	Rating	Regulations Applying
Flammable Liquids. (See page 219.)		
Gasolene and Oil Storage, General	P	Tanks or Containers (1925). Discharge of Oil on Waters (1921).
Paints, Cleansing Liquids, etc., Storage and Sale, Manufacture	F	Inflammable Compounds (1914). Paints, Oils and Inflammable Fluids (1917).
Oil Burning Equipments	F	Light Fuel Oil Burners (1923). List of Approved Burners (1928).
Garages	A	Garages, inside Metropolitan District (1923).
Filling Stations	N	
Tank Trucks	N	
Dry Cleaning Establishments	F	Dry Cleaning and Dry Dyeing Establishments (1914).
Paint Spraying	N	
Dip Tanks	N	
Flammable Gases. (See page 223.)		
City Gas, Piping, Gas-Fired Heating Devices	F	Building Code, Regulations (1924).
Acetylene, Manufacture, Storage and Use, including Carbide	N	
Gas Welding and Cutting	N	
Compressed Gases	N	
Refrigeration, Mechanical	P	No regulations except Ammonia Compressor Safety Valve Rules (1928).
Flammable and Explosive Substances. (See page 224.)		
Explosives	A	Explosives (1924).
Fireworks	F	Fireworks (1921).
Pyroxylin Plastic (Celluloid)	P	Celluloid Regulations (1929).
Motion Picture Film Storage	F	Inflammable Motion Picture Film (1916).
Motion Picture Projection	A	Cinematograph for Exhibition of Motion Pictures (1923).
Photographic and X-Ray Nitro-cellulose Film	N ¹	
Combustible Fibers, Substances Subject to Dust Explosion Hazard, etc. (See page 226.)		
Cotton, Kapok and other Fibers	P	Chapter 148, General Laws.
Bags, Waste Paper, etc.	P	Chapter 148, General Laws.
Upholstering	P	Chapter 148, General Laws.
Hay, Straw and Feathers	P	Chapter 148, General Laws.
Pulverized Fuel Systems	N	
Woodworking	P	Chapter 148, General Laws.
Industries Subject to Dust Explosion Hazard	N	

¹ See footnote page 226.

Topics	Rating	Regulations Applying
"Common Hazards." (See page 227.)		
Heating Devices, General	F	Building Code.
Chimneys and Flues, Smokepipes	F	Building Code.
Ventilating and Conveying Systems	P	Building Code.
Rubbish	P	Chapter 148, General Laws.
Ashes	P	Building Code.
Electric Wiring and Equipment	A	Rules and Requirements of the Fire Commissioner (Wire Division).
Miscellaneous Hazards. (See page 228.)		
Internal Combustion Engines	P	Building Code and Chapter 148, General Laws.
Fumigation Operations	N	
Fat Boiling	A	Building Code.
Salamanders	P	Chapter 148, General Laws.
Life Safety and Restriction of Spread of Fire. (See page 228.)		
Building Construction, General; and Special Features to Restrict Spread of Fire.	F	Building Code.
Exits	P	Building Code.
Theaters and Other Places of Public Assembly	A	Building Code.
Schools	P	Building Code.
Fire Extinguishing Equipment. (See page 229.)		
Automatic Sprinklers	F	Building Code and various regulations.
Fire Extinguishers, Pails, etc.	P	Building Code and various regulations.
Standpipe and Hose Systems	F	Building Code.
Water Supplies, Fire Pumps, Tanks: Gravity, Pressure	N	
Foam and Carbon Dioxide Extinguishing Systems	N	

(Three publications circulated by the Fire Marshal's Office, Elevator and Escalator Regulations (1923), Fire Protection for Horses and Mules, Law (1924), Air Tank Regulations (1924), are not considered of sufficient importance from the viewpoint of this survey to require any special comment; the titles are included here in order that the list may be complete.)

The following paragraphs discuss the subjects outlined in the preceding table. These are not all covered in detail, a few typical subjects having been selected for analysis. Others might be treated in similar detail, but this would take more space than is warranted and is not necessary as the subjects cited illustrate the situation.

FLAMMABLE LIQUID HAZARDS

Massachusetts Regulations:

Construction, Use and Maintenance of Tanks or Containers (1925).

Discharge of Oil on Waters (1921).

Manufacture, Storage, Keeping and Sale of Inflammable Compounds, and the Storage and Handling of Volatile Inflammable Liquid in Connection therewith (1914).

Keeping, Storage and Use of Paints, Oils and Inflammable Fluids (1917).

Some details of the hazard of gasoline and other flammable liquids are adequately treated, but in general the regulations are distinctly unsatisfactory. The outstanding point of criticism is the lack of any general regulations applying to gasoline and oil storage and handling; various regulations apply to a number of specific uses of flammable liquids, but there are many important phases not covered in any way.

The Regulations on Tanks or Containers apply to all tanks other than wood for liquids other than water, and are apparently drawn solely from the viewpoint of mechanical strength and reliability, for the purpose of preventing collapse and escape of liquid. No features of fire hazard are covered. Important items omitted are piping, venting, location with respect to other structures, and the elimination of fire hazards in the vicinity. Such matters are covered if the storage is in connection with the manufacture of a flammable compound, or a garage, but not for flammable liquid storage in general. The provisions for strength of containers are in excess of those specified in the N. F. P. A. Suggested Ordinance on Flammable Liquids, calling for a heavier construction and additional expense not justified on the grounds of public safety.

The regulations prohibiting the discharge of flammable liquids into or on the streams or other waters of the Commonwealth are in accordance with good current practice.

The regulations on Inflammable Compounds are fairly good as applied to small plants manufacturing metal polishes and the like, to cover the hazards of which they were apparently drawn. These regulations do not appear appropriate for application to larger establishments; the maximum limit of 30 gallons of flammable liquid inside the building would be prohibitory in many cases.

The Paint and Oil Regulations are reasonably satisfactory as far as they apply, but are limited in their application to paint shops or stores in dwellings or within 50 feet of dwellings. It is obvious that this is a hazard which should be subject to appropriate regulation irrespective of the location of the building with respect to dwellings.

The flammable liquid hazard in garages is in general well covered in the regulations on this subject, though the permission to fill automobile tanks inside buildings is questionable, and exception might be taken to some other details of the regulations. A separate pamphlet of regulations applies to garages outside the Metropolitan District; there seems to be no logical reason for not covering the hazards of garages in a single pamphlet of regulations applying to the entire state.

No published regulations apply to gasoline filling stations (though permits must be obtained for these), nor to the handling of gasoline through the streets in tank trucks; these important subjects seem logically the subject of appropriate state regulations.

OIL BURNING EQUIPMENTS

Massachusetts Rules and Regulations Governing Light Fuel Oil Burners (1923).

The Massachusetts regulations cover the more important features of fire hazard, although silent on many details covered in the N. F. P. A. Regulations for the Installation of Oil Burning Equipments and for the Storage and Use of Oil Fuels in Connection Therewith (1928), and apparently unnecessarily drastic in some features. Industrial type burners, and other burners using heavy fuel oil, are apparently beyond the scope of the Massachusetts regulations as indicated by the title; this is an important feature as a large number of fires occur in connection with equipments burning heavy fuel oil.

The Massachusetts regulations properly provide that oil burners shall be subject to the approval of the State Fire Marshal, and that no burners shall be used which are not so approved. Proper determination of the fire hazard of individual makes of oil burner, and the reliability of their safety devices under operating conditions, requires comprehensive laboratory tests, which state and local fire prevention authorities ordinarily do not have the facilities to make, and would involve a heavy expense if made locally. It is accordingly the custom of many authorities having jurisdiction similar to that of the Massachusetts State Fire Marshal to be guided in their approvals by the findings of Underwriters' Laboratories. Underwriters' Laboratories, a national, nonprofit organization devoted to testing the fire hazard and safety features of devices and materials, with its findings subject to review by the United States Bureau of Standards in cases of dispute, is the universally recognized authority in matters of this kind. The Laboratories List of Inspected Appliances names some 90 makes of domestic and a dozen industrial oil burners which have been tested and found satisfactory from the viewpoint of fire hazard. This list is comprehensive, as the situation with respect to insurance and municipal requirements throughout the country is such that there is a strong commercial incentive for any manufacturer whose burner can pass the necessary tests to have his product listed.

The Massachusetts Fire Marshal issues a list of Approved Light Fuel Oil Burners, containing the names of over two hundred burners. This includes practically all the Underwriters' Laboratories listed burners which are sold in the state, but the majority of the burners on the Massachusetts List do not appear on the Underwriters' Laboratories List.

The requirements for oil storage tanks are somewhat similar in the N. F. P. A. and Massachusetts regulations, but the latter are considerably more restrictive. The size of oil storage tanks inside buildings (tanks not buried under basement floor) is limited by the Massachusetts regulations to a maximum of 1,000 gallons. The N. F. P. A. regulations permit inside storage tanks up to 25,000 gallons individual capacity depending on the construction of the building and subject to appropriate requirements for insulation and protection.

The Massachusetts regulations permit underground tanks, either under buildings or outside, buried to a depth of 12 inches without any protection other than that afforded by the earth covering. The N. F. P. A. regulations specify that where outside underground tanks are less than two feet below the surface they shall be protected by a concrete slab, and that tanks under buildings shall be so protected in any case.

The Massachusetts regulations make no provision for outside above-ground storage tanks of over 275 gallons. The N. F. P. A. regulations set no limit on such storage but make appropriate provision for safeguarding the hazard involved, including requirements for construction of tanks, minimum distances from buildings, etc.

The Massachusetts regulations specify a fusible link device to shut off oil automatically in case of fire. This is not required by the N. F. P. A. regulations, not being considered a necessary feature.

Tanks and piping of pressure systems should be given a pressure test after installation, to assure oil tightness. No such requirement is made in the Massachusetts regulations.

Various additional points of difference between the two sets of regulations might be cited, and mention made of numerous other features detailed in the N. F. P. A. regulations, but not covered in the Massachusetts regulations. The points mentioned in the preceding paragraphs, however, serve sufficiently for the purposes of this review to indicate the general character of the differences.

DRY CLEANING

Massachusetts Regulations Governing Dry Cleaning, Dry Dyeing and Sponging Establishments, and the Storage and Handling of Volatile Inflammable Liquid in Connection Therewith (1914).

These regulations were presumably in accordance with good current practice when promulgated in 1914. While developments in dry cleaning practice since 1914 have not invalidated the main features of these regulations, they are in various details out of line with best current practice, as indicated by the N. F. P. A. Regulations on Dry Cleaning and Dry Dyeing Establishments. (Edition of 1925, amended 1927.)

Static electrical sparks are a frequent cause of fire in dry cleaning establishments. The danger of static electricity is accentuated when the atmosphere humidity is low, and practically eliminated when the humidity is high. Whenever the humidity falls below 60 per cent. the air in the plant should be artificially humidified to maintain a relative humidity of 60 per cent. specifying either automatic or manual means (*e. g.*, steam jet). The Massachusetts regulations make no mention of relative humidity.

The Massachusetts regulations specify steam smothering connections for the purpose of fire extinguishment. In addition to steam, the recently developed carbon dioxide gas extinguishing systems are particularly suited to this type of occupancy and should be recognized.

The N. F. P. A. regulations specify valves controlled by fusible links, with pipe connections to purifiers, clarifiers and other tanks containing flammable solvents, to empty the contents to underground tanks automatically in case of fire. No such provision is made in the Massachusetts regulations.

The Massachusetts regulations impose a limit of 2,000 square feet for the area of buildings used for washing or immersing purposes, and specify that such buildings shall be at least 20 feet distant from other buildings. The N. F. P. A. regulations impose no limit on area, but indicate provisions for construction and protection to safeguard the hazard without the necessity of limiting the area, and permit location of dry cleaning buildings with walls (on two sides) on the lot line, provided such walls are of standard brick construction without openings.

The Massachusetts regulations require underground storage tanks of heavier metal than specified by the N. F. P. A.

PAINT SPRAYING, DIP TANKS, ETC.

Paint spraying in furniture manufacture, automobile refinishing, etc., involves a fire hazard which has been largely introduced during the past few years and where not properly handled from the fire safety standpoint has been responsible for fires causing heavy losses of life and property. Appropriate state regulations, based on the N. F. P. A. Regulations on Paint Spraying and Spray Booths, could largely do away with the hazard of this process. There are at present no Massachusetts regulations on this subject.

Other finishing processes, involving the use of flammable liquids, such as dip tanks, are not now covered by Massachusetts regulations. They should be similarly treated.

FLAMMABLE GASES

With the exception of city gas, and ammonia compressor safety valves, no regulations apply to the well known hazard of acetylene, other gases used in welding and cutting operations, manufacture of acetylene and storage of calcium carbide, hydrocarbon and other compressed gases.

City Gas. [Boston Building Code, Regulations (1924).] These regulations are unusually comprehensive and except for a few features are in line with the N. F. P. A. Regulations for the Installation, Maintenance and Use of Piping and Fittings for City Gas. The Boston regulations are lenient with respect to the use of flexible gas tubing. They do not provide for as large supply pipes for

the same number of burners as do the N. F. P. A. regulations but it may perhaps be assumed that the desire of the gas company to give customers adequate service will result in sufficiently large piping irrespective of the provisions of the Boston regulations.

It is interesting to note that these regulations apply only in the City of Boston. There is no difference between the hazard of city gas in Boston and in other cities of the State, and it would appear reasonable to have a single set of regulations applying throughout the State.

REFRIGERATION

Mechanical refrigeration employs various gases as refrigerants, practically all of which are flammable or explosive, or which because of their noxious qualities may interfere with fire fighting operations in buildings where such refrigeration equipment is installed. Mechanical refrigeration, widely employed in cold storage plants, stores handling meats and other food products, hotels, apartment houses and other occupancies, is properly a subject for regulation of fire hazard features and is so regulated in many cities.

The hazard of mechanical refrigeration is not covered by any Massachusetts regulations except for the single detail of ammonia safety valves. The Ammonia Compressor Safety Valve Rules, formulated by the Board of Boiler Rules (1928) cover this particular subject in a comprehensive manner, and also include valuable emergency instructions for procedure in case of ammonia leaks. Nothing is found in Massachusetts state regulations, however, on any other refrigerant, nor on any detail of ammonia systems other than the safety valve.

FLAMMABLE AND EXPLOSIVE SUBSTANCES

The subjects listed under this caption in the foregoing table are more comprehensively treated than those listed under other captions. The most serious gap in this group is the absence of any regulations to cover the hazard of pyroxylin plastic (celluloid) in general, the existing regulations covering only the use of this material in shoe manufacturing, and motion picture film.

Explosives. [Massachusetts Rules and Regulations Governing the Keeping, Storage, Use, Manufacture, Sale, Handling, Transportation or other Disposition in this Commonwealth of Explosives (1924).]

These regulations appear to be adequate to cover the hazards involved. By reason of distance and other requirements, the regulations in effect prohibit the quantity storage of explosives in the City of Boston. There may be some question as to whether all these requirements are necessary from the viewpoint of public safety, but compliance with these regulations should eliminate any undue hazard in the city.

Fireworks. [Massachusetts Rules and Regulations Governing the Keeping, Storage, Transportation, Manufacture, Sale and Use of Fireworks (1921).]

Fireworks in the hands of children and the general public constitute a fire and life hazard that is considered wholly unnecessary by fire prevention and safety authorities who generally recommend that the use of fireworks be limited to public displays under the supervision of fire department officers or other competent persons. From this viewpoint the requirements applying in Boston are defective in that they permit the sale of firecrackers and other fireworks to the public, though limiting the size of firecrackers and the period during which fireworks may be sold and making other restrictions. The Massachusetts regulations specify permits for the sale of fireworks, limit the quantity of fireworks in any store, and prohibit their storage or sale in residence and certain other classes of buildings. While these requirements are not sufficient to eliminate the hazard, they are perhaps as comprehensive as is practicable so long as the public sale of fireworks is to be permitted.

Pyroxylin Plastic (Celluloid). [Massachusetts Regulations Governing the Keeping, Storage and Use of Celluloid and of Volatile Inflammable Liquids or Compounds Used in Connection Therewith in the Manufacture of Shoes or any of the Parts Thereof (1929).]

These regulations, taking effect March 11, 1929, were prepared by the State Fire Marshal following the Preble Box Toe Company explosion and fire in Lynn, November 8, 1928, in which twenty lives were lost. These regulations represent an improvement in certain features over the 1914 regulations on the same subject which they supersede, but like the previous edition neither specify proper provisions to cover the special hazard involved nor do they serve to facilitate manufacturing operations.

These regulations apply only to the manufacture of shoes and parts thereof. In recent years the uses of celluloid (pyroxylin plastic) have been greatly extended and it is now widely employed for many purposes. The well known fire hazard of this material should be covered by appropriate regulations, irrespective of the particular purpose for which it is used. The hazard has been covered by the N. F. P. A. in the Regulations for the Storage, Handling and Use of Pyroxylin Plastic in Factories Making Articles Therefrom (1928) and in the Regulations for the Storage and Sale of Pyroxylin Plastic in Warehouses and Wholesale Jobbing and Retail Stores.

The Massachusetts regulations are so far removed from the above-mentioned N. F. P. A. regulations that no detailed comparison is feasible. One feature, however, may be mentioned as an illustration. The Massachusetts regulations

provide that all stocks of celluloid in excess of one day's supply shall be stored in an isolated structure. This would have the effect of making the regulations prohibitory in most built-up areas. The N. F. P. A. regulations permit storage of reserve stocks inside manufacturing or other buildings, specifying sprinklered, ventilated storage vaults or cabinets (depending on quantity stored), thus securing reasonable fire safety without prohibitive expense.

Motion Picture Film Exchanges. [Massachusetts Regulations Governing the Storage, Keeping and Handling of Inflammable Motion Picture Films and the Construction and Maintenance of Buildings in Connection Therewith (1916).]

These regulations are fairly comprehensive and compare favorably in many respects with the N. F. P. A. Regulations for Nitro-cellulose Motion Picture Film (1926). The only major discrepancy is in respect to automatic sprinkler protection, which the latter require for all storage vaults and other areas where film is handled. The Massachusetts regulations specify sprinklers in certain portions, but do not call for them to protect the film storage proper.

Motion Picture Projection. [Massachusetts Laws, Rules and Regulations Governing the Use of the Cinematograph and Similar Apparatus for the Exhibition of Moving Pictures (1923).]

These regulations are comprehensive and are in the main in harmony with similar requirements in other cities. Certain deviations from the provisions of the National Electrical Code are not of major importance. The Massachusetts regulations may be considered unduly stringent in their restrictions on cellulose acetate ("safety") film which is not hazardous.

X-Ray Film.¹ There are no Massachusetts regulations on photographic and X-ray nitro-cellulose film, which constitutes a serious hazard when stored in quantity in hospitals and similar institutions.

COMBUSTIBLE FIBERS, SUBSTANCES SUBJECT TO DUST EXPLOSION HAZARD, ETC.

Chapter 148 of the General Laws contains the provision that storage and handling of straw, excelsior, shavings, cotton and similar materials are prohibited in or within fifty feet of buildings used for residence purposes. The same chapter empowers the fire marshal to order automatic sprinklers in such occupancies, and to order the removal of waste materials that may be a fire menace. Other than

¹ Since the completion of this study the Cleveland Clinic disaster, in which 123 persons were killed due to an X-ray film fire, occurred on May 15, 1929. This resulted in the issuance by the Department of Public Safety on October 9 of Regulations Governing the Keeping, Storage, Use and Handling of Nitrocellulose X-ray Film. These regulations are very drastic in many features. If enforced they would presumably operate to force the use of cellulose acetate (safety) film in place of the nitrocellulose variety. A better method of obtaining this manifestly desirable result would have been to prohibit the nitrocellulose film specifically as New York State has done. The regulations appear to work an unnecessary hardship on hospitals which must retain old nitrocellulose film for a period of years.

this there are apparently no regulations which apply to the various hazards under this heading. While the authority of the fire marshal to make regulations here is perhaps not so clearly indicated as in the case of some other hazards, the intent of the legislation would apparently permit the fire marshal to promulgate much needed regulations to control the more serious phases of this class of hazard.

“COMMON HAZARDS”

Furnaces and heating boilers are covered by the Boston Building Code in a fairly satisfactory manner, although because of lack of provision for stoves and other small heating devices this general subject cannot be considered as adequately treated.

The Building Code covers the construction of chimneys, including proper provisions for thickness of walls, lining, etc., but it does not limit the number of openings into a single chimney flue (fire frequently spreads through such openings), and does not require the construction of chimneys solid from the ground up. The placing of chimneys on brackets or struts, even though such supports be of incombustible material as provided by the Boston Building Code, is generally regarded by fire prevention authorities as a serious fire hazard.

The provisions of the Building Code regulating smokepipes are generally satisfactory.

Ventilating systems, and blower or exhaust systems for conveying refuse and other combustible materials in industrial plants, deserve careful consideration from the fire prevention viewpoint. Fires frequently originate in such systems, or they are the means of spreading fires through buildings. The Boston Building Code contains a few provisions applicable to such systems, but they are not sufficiently comprehensive to be considered satisfactory.

Rubbish is one of the most important of all fire hazards, and one which is most easily eliminated. Chapter 148 of the General Laws gives the State Fire Marshal authority to prohibit or regulate the accumulation of combustible rubbish or require its removal. No regulations on this subject have been promulgated. This matter is now handled through individual orders requiring the removal of rubbish; it would seem that this hazard could be much more effectively controlled if there was a law or regulation definitely placing upon the property owner or tenant the responsibility for keeping the premises clean, rather than depending solely on orders to remove rubbish which has accumulated.

Hot ashes placed in wooden barrels or boxes, or against woodwork, constitute a frequent cause of fire. The Boston Building Code provides that ashes shall be placed in a “suitable receptacle,” but does not define a “suitable receptacle” or indicate in any way that such receptacles should be of metal or other incombustible material.

ELECTRIC WIRING AND EQUIPMENT

Rules and Requirements of the Fire Commissioner (Wire Division) of the City of Boston (1927).

These regulations are based upon, and contain only minor deviations from, the National Electrical Code, which is the nationally recognized standard of good practice in electric wiring and equipment. The regulations are thus comprehensive and generally satisfactory.

MISCELLANEOUS HAZARDS

Many different hazards might be considered under this heading; four typical items have been selected for mention here.

Internal combustion engines employing gas, gasoline or oil for fuel constitute a hazard by reason of the fuel, the engine itself, and the exhaust. The Building Code contains some provisions applying to gas engines and exhaust pipes, and Chapter 148 of the General Laws limits the amount of liquid fuel that may be used with internal combustion engines. In general, however, the treatment of this hazard is incomplete and unsatisfactory.

Fumigation operations are hazardous because of the flammable nature of some of the materials used, because of the open flames involved in some methods of fumigation, and because of the hampering of the Fire Department in fighting a fire in a building at the time of fumigation. Chapter 148 of the General Laws gives the Fire Marshal authority to promulgate regulations on this subject. No such regulations have been issued so far as could be determined.

Fat boiling is prohibited in tenements by the Boston Building Code, except where a fire cut-off is provided between the area where the fat is boiled and the other portions of the building. This follows current good practice as reflected in other building codes and is generally satisfactory.

Salamanders are referred to in Chapter 148 of the General Laws, which specifies the precautions necessary when salamanders are placed on wooden floors. The fire marshal is given authority to prescribe the conditions under which salamanders may be used, but no regulations on the subject have been issued. Furthermore the wording of Section 35, Chapter 148, may be interpreted as applying only to salamanders used for drying plaster and not applying, for example, to salamanders used for preventing the freezing of wet concrete. Under the circumstances the treatment of this subject must be considered only partially effective.

LIFE SAFETY AND RESTRICTION OF SPREAD OF FIRE

A detailed discussion of the various building code provisions is beyond the scope of this review. In general it may be said that the provisions for enclosure of stairways and elevator shafts, fire stopping and like features are consistent with average building code practice.

Exits. Except for theaters, the general requirements for exits in Boston are very indefinite in the Building Code. The Building Commissioner is given broad discretionary powers to require such exits as he considers necessary, which with a competent official provided with an adequate staff may result in a proper handling of this feature of building construction. In the case of theaters, exit requirements are detailed and specific; there seems to be no good reason for not making more definite exit requirements for other classes of buildings. The present Building Code places a heavy responsibility on the Building Commissioner, and gives practically no guidance to the architect or builder. In general, the exit provisions of the Boston Building Code must be considered as distinctly unsatisfactory. (Chapter 2.)

Theaters. The exit and other fire safety provisions of the Building Code applying to theaters are in the main adequate and compare favorably with similar regulations in other cities.

Schools. The Boston Building Code exempts public schools from most of its provisions. Chapter 143 of the General Laws covers the fire safety of schools, and under its authority regulations have been promulgated by the State Department of Public Safety. Chapter 143, however, also largely exempts Boston from its provisions. It thus appears that in matters of building construction and fire safety the schools are largely exempt from any regulation or control except that exercised by the City of Boston Schoolhouse Department itself.

FIRE EXTINGUISHING EQUIPMENT

Automatic sprinklers are required by the Boston Building Code and by regulation of the State Fire Marshal in various specified locations. Broad authority is given to the State Fire Marshal to order the installation of sprinklers wherever hazardous conditions exist. The Building Commissioner is given authority to order the installation of sprinklers in the basements of mercantile buildings and in tenements over a certain size. These provisions as far as they go are satisfactory when viewed in the light of average municipal requirements for automatic sprinklers.

Automatic sprinkler installations required by the Boston Building Code are subject to the approval of the Building Commissioner. The Building Commissioner has issued regulations on automatic sprinkler equipments which together with the Commissioner's authority over the plans of each installation result in generally satisfactory installations substantially in accordance with the regulations of the National Fire Protection Association on the installation of automatic sprinklers, the nationally recognized standard on this subject.

In the case of automatic sprinkler installations ordered by the State Fire Marshal, the authority of the Building Commissioner does not apply and there are no published regulations to control such installations. The absence of published specifications as to what constitutes an automatic sprinkler system as ordered by the State Fire Marshal operates to largely nullify the order for their installation. This was shown by the case of *Commonwealth vs. Edward B. Badger* (243 Mass. 137) where the fire marshal's order to install automatic sprinklers was found invalid by the State Supreme Court because of the absence of any regulations or other information from the State Fire Marshal giving specifications for the sprinkler system. (See Appendix 13 B.) Several years have elapsed since this decision, but no regulations have been issued by the fire marshal.

Fire extinguishers, pails, etc., are also required by the Building Code and by various state regulations. Here again there are no specifications as to what constitutes a fire extinguisher, nor is there any list of extinguishers approved by the State Fire Marshal. The listings of Underwriters' Laboratories would be an appropriate guide in such approval, as explained in the preceding paragraphs dealing with oil burning equipments.

Standpipe and hose systems are covered in the Building Code in a fairly comprehensive manner, although there are some deviations from current good practice.

Water supplies for private fire protection, including fire pumps, gravity tanks and pressure tanks are customarily covered in more or less detail in municipal regulations. There are no such regulations in Boston.

Fires in certain hazardous occupancies using flammable liquids and other materials which cannot be readily extinguished by the use of water, are most advantageously handled through special extinguishing means such as foam or carbon dioxide. Apparently no provision is made in any regulations for the use of such special extinguishing methods in Boston.

CONCLUSIONS

The fire prevention regulations applying in the City of Boston are seriously defective. The laws and regulations are very confusing because of lack of codification and because of illogical division of jurisdiction between the state and local authorities. Some subjects are covered excellently, but the treatment of the majority is distinctly unsatisfactory because of (1) total lack of regulations on a number of important subjects, including many on which the promulgation of regulations has been authorized, (2) incomplete character of regulations on a number of subjects, (3) obsolete character of various regulations which were good when issued, but which have not been revised (as authorized by law) to keep pace

with developments in industry and business and (4) inclusion of some unnecessarily drastic provisions which tend to discredit the regulations and make their enforcement difficult.

Codification rather than any change in fundamental intent is required to make existing fire prevention legislation yield the results for which it was designed. There is no logical reason for the present confusing and ill-defined division of jurisdiction between state and city authorities and differences between the laws applying to Boston and those applying to other cities in the state. The laws should be codified and so revised as to unify all fire prevention authority, or at least to make the division of jurisdiction clear and along logical lines. Existing obsolete regulations should be revised to conform with the best current practice, and new regulations drafted on subjects not now covered where there is legal authority to prepare regulations. All unnecessarily drastic provisions should be eliminated in the interest of securing a body of rules which would be generally recognized as reasonable and proper and which might therefore be more readily enforced.

CHAPTER 14

AUTHORITY FOR FIRE PREVENTION INSPECTION

Authority is provided in the various laws for such inspections as must be made by building, boiler and elevator inspectors, and these are not covered in detail here. While there appears to be adequate authority for inspections by the Fire Department, the distribution of authority and responsibility is very confused. This is important because inspection furnishes the principal means by which fire prevention laws and regulations are enforced.

Primary authority for inspection work is given to the Fire Commissioner under the following section of chapter 39 of the statutes relating to the City of Boston. (1908):

SECTION 2. The fire commissioner or the other officers of the department shall have the same authority in regard to the prevention and extinguishment of fires and the other offices and duties now incumbent upon firewards as are now conferred upon firewards by the Revised Laws or the special acts relating to the city of Boston, now in force. The fire commissioner may, and upon the complaint of a person having an interest in any building or premises or property adjacent thereto, shall, at all reasonable hours, enter into buildings and upon premises within his jurisdiction and make an investigation as to the presence of combustible materials or the existence of conditions liable to cause fire. He shall in writing order such materials, if found, to be removed and such conditions, if existing, to be remedied. The owner or occupant of such building or premises may, within twenty-four hours after notice of such order, apply to the deputy chief of the district police,¹ by whom the matter shall be forthwith investigated. Unless he revokes the order, it shall remain in force and be at once obeyed by said owner or occupant, who, if he refuses or neglects to comply therewith, shall be punished by a fine of not less than ten nor more than fifty dollars for each day during which such refusal or neglect continues.

This gives the Fire Commissioner adequate authority, but appeal from his orders to the state authorities is provided which makes close cooperation from the State Department of Public Safety essential if the Fire Commissioner's authority is to be effective. Similar authority to the above is given to the heads of fire departments in cities and towns outside of the Metropolitan Fire Prevention District, but no appeal to the Fire Marshal is provided for. (Section 6, Chapter 148, General Laws.)

¹ This would probably be interpreted to mean the State Fire Marshal under the present official set-up.

THE METROPOLITAN FIRE PREVENTION DISTRICT

Section 28 of Chapter 148, General Laws, establishes a district made up of most of the cities and towns of greater Boston, in which the authority for fire prevention work is entirely vested in the State Fire Marshal. By Section 28 the following cities and towns are made a part of the district.

Arlington.	Lynn.	Saugus.
Belmont.	Malden.	Somerville.
Boston.	Medford.	Waltham.
Brookline.	Melrose.	Watertown.
Cambridge.	Milton.	Winchester.
Chelsea.	Newton.	Winthrop.
Everett.	Quincy.	Woburn.
	Revere.	

By acceptance of this section the following communities have become a part of the district.

Lexington.	Rockland.	Williamstown.
Reading.	Stoneham.	Wilmington.

Of these, only three, Lexington, Reading and Stoneham, are part of the greater Boston census district. Wilmington and Rockland are adjacent to it, while Williamstown is in the western part of the state. (See Fig. 234.)

For convenient reference, Chapter 148 of the General Laws corrected as amended through 1928 is given in Appendix 14. According to Section 2, certain sections of this chapter apply only to the Metropolitan Fire Prevention District, while certain others do not. In reading the law, it is extremely difficult to follow the application of these sections, which makes it difficult for the local fire department to know just where its responsibility lies.

AUTHORITY OF FIRE MARSHAL IN METROPOLITAN FIRE PREVENTION DISTRICT

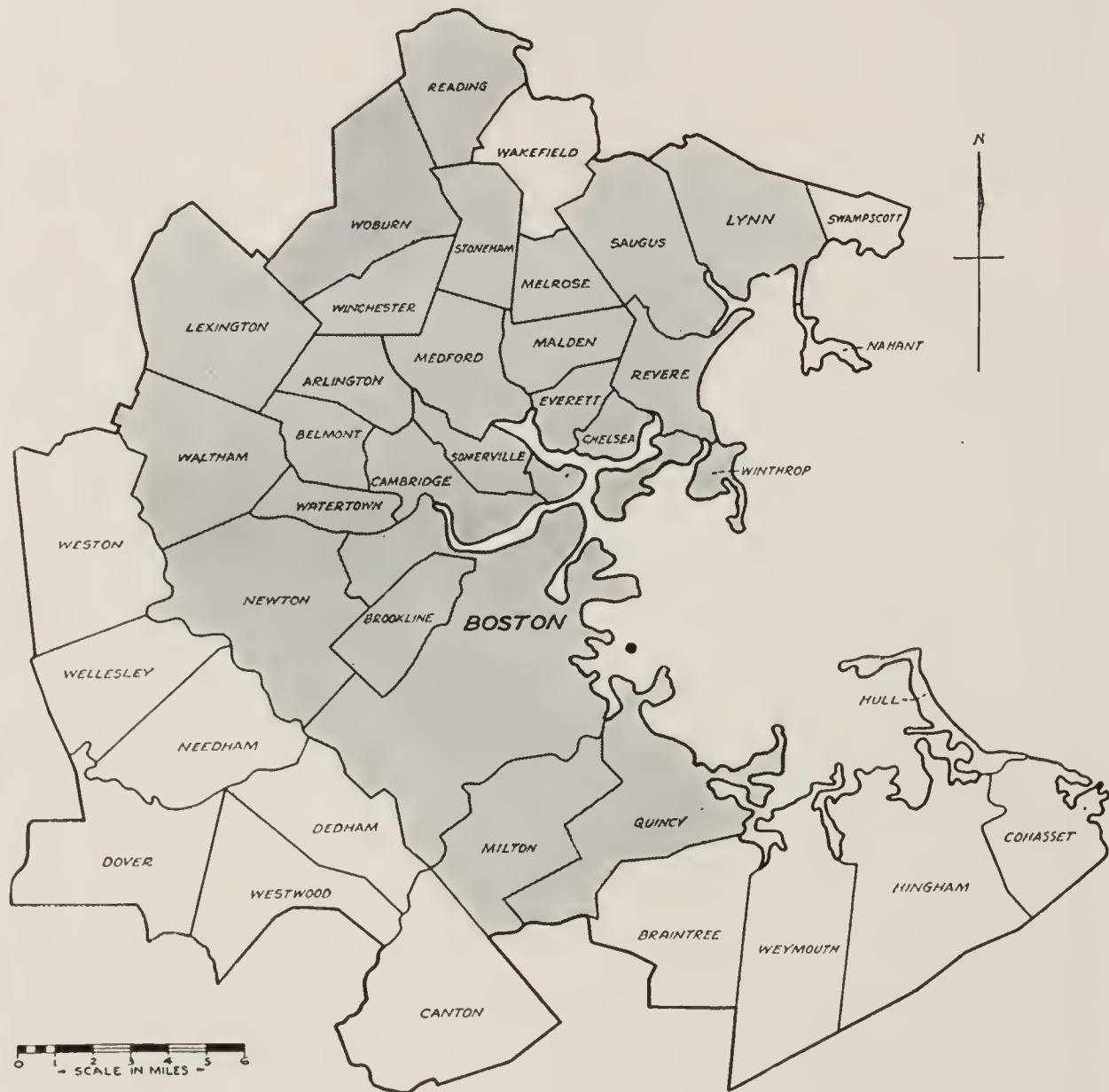
The line of authority is further complicated by the provisions of Section 30:

SECTION 30. The marshal shall have within the metropolitan district the powers given by sections ten, thirteen, fourteen, twenty, twenty-one and twenty-two to license persons or premises, or to grant permits for, or to inspect or regulate, the keeping, storage, use, manufacture, sale, handling, transportation or other disposition of gunpowder, dynamite, nitroglycerine, camphine or any similar fluids or compounds, crude petroleum or any of its products, or any explosive or inflammable fluids or compounds, tablets, torpedoes, rockets, toy pistols, fireworks, firecrackers, or any other explosives, and the use of engines and furnaces as described in section one hundred and fifteen of chapter one hundred forty; provided, that the city council of a city or the selectmen of a town may disapprove the

METROPOLITAN BOSTON

(AS DEFINED FOR CENSUS PURPOSES)

SHADED AREAS SHOW CITIES AND TOWNS IN
METROPOLITAN FIRE PREVENTION DISTRICT



METROPOLITAN FIRE PREVENTION DISTRICT ALSO INCLUDES TOWNS OF
ROCKLAND, WILLIAMSTOWN AND WILMINGTON NOT SHOWN ON THIS MAP

MAYOR'S FIRE SURVEY OF BOSTON
HORATIO BOND — CHIEF ENGINEER

FIGURE 234.

granting of such a license or permit, and upon such disapproval or upon the refusal to grant or issue the same by the officer or board designated for the purpose by the marshal under the following section, the license or permit shall in no event be granted or issued. In Boston certificates of renewal of licenses as provided in Section fourteen shall be filed annually for registration with the fire commissioner, accompanied by a fee of one dollar.

Section 10, referred to above, authorizes the marshal to make regulations on hazards like those enumerated in the above section 30. Sections 13 and 14 cover licensing procedure in the state as a whole. (Sections 20, 21 and 22 refer to inspection of petroleum.) In Sections 13 and 14 the local licensing authority may grant licenses for certain hazards such as garages or the storage of gasoline, but a permit is required from the marshal as well as the local license. By section 30 the marshal has the authority to issue licenses as well as permits in the metropolitan district. The local licensing authority has the right to refuse a license but not to grant it. The marshal usually delegates this licensing authority to the local city council but reserves the right to review their decision. (See fuller discussion of this subject later in this chapter.) Similarly, he usually delegates the authority for issuing permits to the local fire department. (See provisions of Section 31 of Chapter 148.)

Among other powers granted the marshal in the metropolitan district are those covered by the following sections:

SECTION 34. The marshal or such person as he may designate may require the removal and destruction of any heap or collection or refuse or debris that in his opinion may become dangerous as a fire menace.

Neglect on the part of either the owner or occupant of both, to remove the cause of complaint under this or the preceding section, after notice thereof has been served, shall be deemed a refusal; and the marshal or the person whom he may designate may enter upon the premises and remove such material or article and the containers thereof as may be covered by or mentioned in the notice issued. The material or articles removed, if of no substantial value, shall be destroyed; otherwise they shall be placed in storage, and the total costs attending such action shall be paid by the owner or occupant.

SECTION 39 (as amended by Sections 4 and 5 of Chapter 325 of the Acts of 1928). In addition to the powers given by sections thirty to thirty-eight, inclusive, the marshal may make orders and rules relating to fires, fire protection and fire hazard binding throughout the metropolitan district or part thereof of binding upon any person or class of persons within said district, limited, however, to the following subjects:

A. Requiring the keeping of portable fire extinguishers, buckets of water or other portable fire extinguishing devices on any premises by the occupant thereof and prescribing the number and situation of such devices.

B. Prohibiting or regulating the accumulation and requiring the removal of combustible rubbish, including waste paper, cardboard, string, packing material, sawdust, shavings, sticks, rags, waste leather and rubber, boxes, barrels, broken furniture and other similar light or combustible refuse.

C. Prohibiting or regulating the setting or burning of fires out of doors.

D. Causing obstacles that may interfere with the means of exit to be removed from floors, halls, stairways and fire escapes.

E. Ordering the remedying of any condition found to exist in or about any building or other premises or any ship or vessel in violation of any law, ordinance, by-law, rule or order in respect to fires and the prevention of fire.

F. Causing any vessel moored to or anchored near any dock or pier to be removed and secured in some designated place, if such vessel is on fire or in danger of catching fire, or is by reason of its condition or the nature of its cargo a menace to shipping or other property.

G. Requiring and regulating fire drills in theaters, public places of amusement and public and private schools.

H. Requiring the cleaning of chimney flues and vent pipes and the installation of spark arresters in chimneys connected with permanent wood burning furnaces.

I. Requiring proper safeguard to be placed and maintained about or over roof skylights and about outer or inner courts or shafts at the roofline.

J. Prohibiting or regulating smoking in factories, workshops and mercantile establishments.

K. Requiring that all signs and advertising devices erected on buildings shall be approved by said marshal.

L. Causing to be made public all violations of fire prevention laws by posting placards on buildings or premises, and by publishing in the daily newspapers the names of the owners and specifying the buildings in which the violation occurs.

M. Defining the classes of buildings to be equipped with sprinkler protection as provided by section thirty-six.

N. Prohibiting or regulating the storage in any lot, building, shed, enclosure or other structures, of any empty wooden packing boxes, cases or barrels in a quantity occupying a space greater than two thousand cubic feet, and regulating the height of piles of lumber in lumber yards.

O. Prohibiting the thawing of water pipes by means of a torch or flame, or the fumigation of warehouses, factories or commercial buildings by the use of any volatile inflammable liquid, or any material requiring flame, without a permit from the marshal.

SECTION 40 (as amended by Section 6 of Chapter 325 of the Acts of 1928). The marshal may provide that any rule shall apply generally throughout the metropolitan district or to any specified part thereof or to any class or description of premises, which shall take effect when approved by the commissioner and the governor and council, and on such dates as they may fix.

The other sections applying to the metropolitan district (Sections 28 to 51 inclusive, see Chapter 148) cover a number of special hazards for certain of which permits must be obtained. Certain of these sections authorize the marshal to require automatic sprinklers and dry pipes in particular occupancies and provide generally for the enforcement of the rules and orders contemplated by the above quoted sections.

These sections also indicate to whom regulations and orders of the marshal shall apply and require the cooperation of local authorities with the marshal. The marshal is empowered to make such inspections as are necessary to carry out his authority and is empowered to pass upon appeals from the decisions of heads of local fire departments. He can also secure reports on fires from heads of fire departments and insurance companies.

The marshal also has certain powers from Section 86 of Chapter 272 of the General Laws relating to the stabling of horses and mules.

Section 5 of Chapter 147 of the General Laws provides for appeal to the Commissioner of Public Safety from decisions of the marshal which are made under authority other than that conferred by Sections 14 or 45 of Chapter 148. As Sections 14 and 45 cover most of the marshal's powers, this provision is applicable in but few cases.

AUTHORITY DELEGATED TO BOSTON FIRE DEPARTMENT

The following authority was delegated to the Fire Commissioner of Boston by the marshal under date of November 12, 1926:

1. "The right to enter at any reasonable hour any building or other premises, or any ship or vessel, to make inspection, or in furtherance of the purpose of any provision of any law, ordinance or by-law, or of any rule or order of said State Fire Marshal, without being held, or being deemed to be guilty of trespass: provided, that there is reason to suspect the existence of circumstances dangerous to the public safety as a fire menace.
2. "The right, at all reasonable hours, to enter into buildings within his jurisdiction where horses or mules are stabled, or upon premises adjacent thereto, for the purpose of enforcing sections 86A to 86D, inclusive, of the Acts of 1924, Chapter 478.
3. "The right to approve or disapprove solely from consideration of fire hazard licenses for the keeping, storage, use, manufacture or sale of explosives and volatile inflammable fluids issued by the Board of Street Commissioners.
4. "The right to require the removal and destruction of any heap or collection of refuse or debris that in his opinion may become dangerous as a fire menace, and all other powers conferred by Section 34 of said Chapter 148.
5. "The right to issue any permit authorized by General Laws, Chapter 148, Sections thirty to fifty-one, inclusive; the carrying out of any lawful rule, order or regulation established by the Fire Marshal, and the right to make any inspection required under said sections."

This delegation superseded a delegation made in 1915, by the Metropolitan Fire Prevention Commissioner. The former delegation in addition to the above delegated the authority of the marshal as covered by paragraphs A, D, E and G of Section 39 (quoted above). In explaining why these provisions were left out of the latest delegations of authority, the marshal informed the Fire Commissioner of Boston that his legal advice was to the effect that these provisions must be carried out by specific order of the marshal, or under general rules established by him. This condition must therefore apply to the specific hazards listed in Section 39, thereby making it necessary for the Boston Fire Department to refer all such matters to the marshal, except where there may be published regulations of the Department of Public Safety to govern.

Technically this situation is fairly satisfactory, but in practice it is very inefficient as it makes necessary the submission to the marshal of many relatively trivial items, which could be better handled directly by the Fire Department.

There is no reason, for example, why the Fire Department may not be charged with the enforcement of paragraph D of Section 39, regarding obstacles on fire escapes or other means of exit.

Furthermore, the local authorities are entirely dependent on the state authorities for enforcement. If a good state of cooperation between city and state authorities exists, this may be no barrier to effective operation. There is, however, definite evidence of a decided present lack of cooperation.

COOPERATION BETWEEN THE FIRE PREVENTION DIVISION OF THE BOSTON FIRE DEPARTMENT AND THE STATE DEPARTMENT OF PUBLIC SAFETY

It was evident from interviews with members of the staff of the fire prevention division that they are very hazy as to the powers and duties imposed on them by the delegated authority from the State Fire Marshal's office, and they report that it is difficult for them to secure enlightenment from that office. Not only is this the case in Boston, but it is apparently the case elsewhere in the Metropolitan Fire Prevention District. For example, the court which held the inquest on the 20 deaths resulting from the Preble Box Toe Company fire in Lynn on November 8, 1928, charged the local fire chief with neglect of duty. It was brought out by the testimony in the case that the local chief apparently did not know that he was responsible for the control of the fire hazards which resulted in this catastrophe.

Most cases of any importance dealing with the correction of fire hazards in Boston are referred to the marshal's office where action cannot be secured locally. To determine what procedure might be best to correct hazards a view of correspondence between the fire prevention division and the State Fire Marshal's office was made, which revealed examples of slowness on the part of that office to act in most important matters, and indicated the deplorable waste of time resulting from such reference. Such inactivity naturally discourages the local department from referring cases to the State Fire Marshal's office.

Many of these cases, relating to various fire hazards, which were examined in detail showed a considerable volume of correspondence often covering several months, and in some cases several years, without action from either authority to correct the hazard.

Cases Involving the Installation of Automatic Sprinklers. These cases are clearly within the jurisdiction of the State Fire Marshal so that the local Fire Department has no choice but to refer them to him. The files contain numerous cases in which the inspector of the fire prevention division of the Fire Department reported that in his opinion, the building inspected was so constructed and so occupied as to require partial or complete installations of automatic sprinklers.

These reports were forwarded to the marshal. In most cases replies from him were to the effect that he had sent an inspector to visit the building in question, that his inspector did not believe that conditions warranted the ordering of automatic sprinklers, and that action on the case was therefore closed. In a number of cases requests for sprinklers were refused on legal grounds because the cost of installing the sprinklers would exceed 5 per cent. of the assessed valuation of the property, or because not more than three persons were located above the second floor of the building or because the occupancy did not come within the provisions of Section 36 of Chapter 148 of the General Laws.

While it is desirable that a responsible official have the deciding authority where the matter of installing automatic sprinkler systems is at issue, it is evident from the large number of recommendations of the local fire prevention division which were rejected that there is lack of cooperation or lack of judgment on the part of either the city or state inspectors. The importance of providing automatic sprinkler systems in dangerous buildings in Boston is so great from the fire prevention standpoint that every effort should be made to require such installations where the hazard is particularly evident. Property owners need fear no improper infringement of their rights, inasmuch as the courts of the commonwealth provide opportunity for appeal from decisions of the marshal's office, which may be considered arbitrary.

Cases Involving Special Fire Hazards. It may be that the serious delays in correcting dangerous fire hazards, especially those due to the handling of flammable or explosive substances, are due to the fact that the authorities are indifferently informed about them and are therefore reluctant to pass on such matters. This delayed action on technical hazards, in addition to perpetuating unsafe conditions, sometimes greatly inconveniences legitimate users of hazardous materials, by making it difficult to secure licenses, permits, or rulings regarding the conditions under which they are using the material in question.

Technical Knowledge in Department of Public Safety. The personnel of the fire marshal's office should be highly qualified by education and training to handle the highly technical work which the law calls upon that division to perform. The condition of the technical regulations promulgated by the department and discussed by the preceding chapter confirms this conclusion. The lack of regulations on important subjects, the omissions and defects in most of the regulations, and the unnecessarily restrictive provisions of many, show that more competent technical experience should be brought to bear in the preparation of the regulations. That numerous sets of regulations are obsolete indicates that the department is reluctant to issue new ones when conditions warrant.

Chapter 148 provides that the marshal may revise or issue new regulations whenever necessary, thus making possible the control of new fire hazards, and the modification of old regulations where, due to changes in manufacturing processes, the hazard is changed or eliminated. The lack of technical knowledge appears to be one reason at least why the regulations of the department have not been developed to the point of adequacy.

As an example no regulations on the important subject of spray paint and lacquer finishing have yet been issued, although there has been considerable demand for them. The Fire Commissioner in Boston in the absence of regulations of the marshal, provided his officers with copies of the standard regulations on paint spraying of the National Fire Protection Association. Although these regulations were backed up by no official authority, they provided the Fire Department with a guide to good practice in connection with this hazard, so that owners of spray painting equipment could at least be advised regarding its safe use.

A member of the staff of the Department of Public Safety is designated a fire prevention engineer. Either his assistance has not been employed in the drafting and revision of the regulations or else his training is not such that he is competent to prepare them. If a competent person had been consulted the regulations on pyroxylin (celluloid) which were revised following the Preble Box Toe Company disaster in Lynn, and issued recently, could have been materially improved. These new regulations are only slightly better than those of 1914 which they superseded. They cover only one phase of the pyroxylin hazard, are obsolete in substance, and contain such impracticable requirements that it is doubtful if they can be enforced.

Section 12 of Chapter 148 authorizes the Department of Public Safety to employ such technical assistance as may be needed. Adequate advantage does not seem to have been taken of this privilege to date, though the department is required to handle highly technical matters.

CHANGES NECESSARY IN THE LAW

The present law (Chapter 148, General Laws) while for the most part technically adequate to provide authority for fire prevention work, is not sufficiently clear to be workable. The multiplicity of its provisions, some of which apply only in certain cities and towns while others apply elsewhere, the overlapping of the provisions of its different sections, and its general lack of codification causes great confusion. The result is that many of its excellent provisions are not observed because they are not understood.

The chapter was apparently drafted to provide authority for fire prevention work in the cities and towns in Boston and vicinity. Other cities and towns may have the benefit of these provisions if they vote to become a part of the Metropolitan Fire Prevention District. Until 1928, a third procedure was open to other communities in the state. They could accept Section 6 and thereby get for their local fire departments authority for fire prevention inspection. Section 6 as amended in 1928, however, extended its provisions to all communities in the state other than those in the metropolitan district,¹ whether they accepted the section or not.

The amended Section 6 makes local fire prevention enforcement matters independent of the state with regard to simple fire hazards which should naturally be controlled by the local fire departments. In this respect the fire departments outside of the Metropolitan Fire Prevention District are now in a better position than those within it, as all fire prevention orders issued by heads of fire departments in the metropolitan district are subject to review by the State Fire Marshal. Where the marshal is slow to act, it takes an indefensible amount of time to get simple yet dangerous fire hazards such as accumulations of rubbish and obstructions to egress from buildings corrected. There is no logical reason why such an appeal should be required within the metropolitan district and not outside it. It is of course desirable that in matters involving special fire hazards there should be the provision for an appeal.²

Section 2 of Chapter 148 should therefore be stricken out and the provisions of Section 6 applied to the metropolitan district as well as to the rest of the state.²

Section 7A indicates four hazards on which the chiefs of fire departments, as well as the State Fire Marshal, may issue orders to apply in specific instances. Section 39 indicates numerous other hazards on which it is clear that the marshal alone can issue orders. These sections should be rephrased so as to make clear that the local fire department may make orders relating, not only to the items covered in Section 7A, but those covered by paragraphs B, C, D, E, F, J and L of Section 39, as well. As far as these items are concerned, the order of the local fire department should not be subject to review by the marshal as no delay in the correction of these hazards should be tolerated.

The subjects covered by Section 39, paragraphs A, G, H, M, N, and O, should, like the hazards enumerated in Section 10, be the subject of general

¹ Chapter 205, Acts of 1929, makes Section 6 (also 7A) apply to the entire state.

² The passage of Chapter 205, Acts of 1929, subsequent to the drafting of the above, modifies the situation somewhat, but leaves it still very confusing. Apparently at present, there could be an appeal to the marshal, in the metropolitan district only, on orders issued by the head of the fire department, when the same are made under authority delegated by the State Fire Marshal.

regulations of the marshal, made and promulgated as provided by Section 11. Paragraphs I and K of Section 39 would be better covered by the building laws.

The wording of Section 10 should be sufficiently comprehensive to authorize the marshal to make regulations on any fire hazard and its protection, or any matter affecting safety to life in fire.

The procedure on licensing and the issuance of permits on certain hazards should be clarified. The issuing of licenses of any character is generally a function of local city councils and similar bodies. In the metropolitan district, however, the marshal has been given the power to issue licenses where fire hazards are involved. The marshal usually delegates this power to these local bodies, but he reserves the right to refuse licenses granted by the local authority. The law does not state that the marshal must limit his grounds for such refusal to considerations of fire hazards only.

A simpler and more efficient procedure would be for the marshal to specify by regulation under what conditions a permit from the local fire department should be required before a license on any given business or occupancy be issued.

RECOMMENDATIONS REGARDING AUTHORITY FOR INSPECTION WORK¹

1. Revise Chapter 148 of the General Laws, with special reference to the following:

(a) Placing the responsibility for fire prevention inspection directly on the local fire departments, and giving them adequate authority to conduct it effectively. This will mean the elimination of Section 2, and will make the act apply uniformly to the whole state. Provide that Section 7A, as well as certain of the provisions of Section 39, be enforced directly by the local fire departments.

(b) Revising the procedure for licensing and the issuance of permits for occupancies involving fire hazards, giving the licensing function to the local authorities, but requiring the Fire Department (and in case of appeal the State Fire Marshal) to pass on matters of fire hazard.

(c) Rearranging the sections of the chapter in logical sequence, taking care to retain its desirable provisions, especially those which provide that the State Fire Marshal be available to meet deficiencies in local enforcement, and those requiring the marshal to provide regulations and directions for the guidance of the local fire departments in controlling fire hazards.

¹ The recommendations of this chapter are, so far as they relate to the revision of Chapter 148, similar to those made by the District Court of Essex County following the inquest into the circumstances of the Preble Box Toe Company fire in Lynn, Massachusetts, on November 8, 1928, which resulted in the death of 20 persons. Lynn is in the Metropolitan Fire Prevention District and enforcement conditions there are similar to Boston.

2. That a competent person be appointed State Fire Marshal, preferably a man with engineering or technical education and experience.

3. The marshal should furnish local agencies with complete regulations and through his deputies he should provide instruction regarding their application to such of the local fire departments' personnel as may be assigned to fire prevention work.

CHAPTER 15

A RECOMMENDED LEGAL PROGRAM

In order to carry out many of the recommendations of this report, changes in the State Laws or City Ordinances will be necessary. These changes are therefore summed up in this chapter in order to make possible the development of a definite program of law revision. The changes which are needed have been outlined in most cases so the reasons for the particular legislation will not be repeated here. With these suggestions, however, it will be possible for the Law Department, in all except the proposed revision of the Building Code, to draft suitable bills for presentation to the General Court, or ordinances for presentation to the City Council.

THE BUILDING CODE

Chapter 2 demonstrates the need for revision of the Building Code and specifies the items of particular importance and indicates the general lines along which revision should proceed. Chapter 8 indicates the need of revision in the specific matter of standpipe requirements.

Under the Boston Building Code the Board of Appeal is empowered to propose revisions. Section 8 of the Code contains the following provision:

It shall be the duty of the Board of Appeal to submit to the mayor on or before the first day of February in each year a report giving a summary of all decisions of the Board, together with such recommendations for revision of the law as the Board may deem advisable. The commissioner [Building Commissioner] shall cause the report to be printed as a separate document for public distribution.

In the revision of any code it is desirable that some representative committee supervise the work. The Board of Appeal provides a committee duly authorized by law to perform the required revision. This is shown by Section 6 of the Building Code:

SECTION 6

BOARD OF APPEAL

There shall be in said department [Building Department] a Board to be called the Board of Appeal. Said Board shall consist of five members appointed by the mayor in the following manner: One member from two candidates, one to be nominated by the Real Estate Exchange and Auction Board and one by the Massachusetts Real Estate Exchange; one member from two candidates, one to be nominated by the Boston Society of Architects and one by the Boston Society of Civil Engineers; one member from two candidates,

one to be nominated by the Master Builders' Association and one by the Contractors and Builders' Association; one member from two candidates to be nominated by the Building Trades Council of the Boston Central Labor Union; and one member selected by the mayor. These appointments shall be subject to confirmation by the Board of Aldermen. The appointments first made shall be for the terms of one, two, three, four and five years, respectively, so that the term of one member shall expire each year. All subsequent appointments shall be for the term of five years. Vacancies shall be filled in the same manner in which original appointments are made. Each member of said board shall be paid ten dollars per day for actual service but not more than one thousand dollars in any one year. No member shall act in any case in which he is interested, and in case any member is so disqualified, or is absent from illness or other cause, the remaining members shall designate a substitute.

All the members of said board shall be residents of or engaged in business in Boston.

Every decision of the board shall be in writing and shall require the assent of at least three members.

The provisions of the above section which limit the Board of Appeal to five members necessarily limit its representativeness. It would be desirable that a building code committee more representative in character of all interests affected be appointed, the Board of Appeal being of course *ex-officio* members of such a committee.

To obtain the best architectural and engineering talent available it will be wisest if such a committee is an unpaid one. In any case the committee should be expected to supervise, rather than to actually draft a new building code. The actual work can best be done by a special consultant experienced in the writing of building codes and their enforcement. The "Hoover" Building Code Committee of the United States Department of Commerce strongly urges this procedure, summing up its advantages as follows:

"Special Consultant. It is best, though not always possible, to secure the services of an architect or engineer experienced in this type of work to write a building code. The services of a specialist are usually expensive as to first cost, but, as in many other fields of endeavor, they will prove well worth while in the end.

"Unless a building code is drafted with extreme care concerning the correctness of its numerous requirements and their relation to each other, obsolete provisions are apt to creep in, also unexpected applications develop which are objectionable and expensive. There is, furthermore, an essential difference between a building specification and a building code, based on the police power which those who draft building codes frequently fail to appreciate. Codes written by competent architects and engineers often take the form

of specifications for good practice instead of stating minimum safe limits. Even definitions frequently are written as specifications. In such cases the result is a code which, because of its numerous and detailed requirements is only partly enforceable, and which is in effect a law applying to the conscientious, but little heeded by those who need regulation most. This pitfall the specialist is more apt to avoid, with greater resultant economy and freedom of structural design. His practice keeps him constantly in touch with the great mass of investigational work being done by laboratories and professional groups and enables him to utilize the latest discoveries in each field. Such a specialist should always work in conjunction with a local advisory committee, and their joint recommendations should be freely submitted to those interested and should be discussed at public hearings before enactment by the local legislative body.”¹

FIRE PREVENTION LAWS

Chapter 14 recommends a complete revision of Chapter 148 of the General Laws on Fire Prevention especially to make clear the authority and responsibility for fire prevention work. That chapter outlines the major changes to be made. Chapter 10 recommends specifically a change in the sections of Chapter 148 relating to automatic sprinklers. Chapter 11 suggests that the law make it clear that the local authorities in Boston are to investigate fires. With these suggestions the city Law Department should draft a suitable revision of Chapter 148. The changes recommended are substantially those made by the recess committee of the General Court which presented a suggested revision of Chapter 148 in 1925.² With that suggested revision and some detailed notes on Chapter 148 which the Fire Survey Staff will place at its disposal, it will be relatively easy for the Law Department to prepare a bill for the next session of the General Court. No attempt to draft the bill is made here because of pending legislation. In presenting a bill next year any action of the General Court taken in 1929 can be considered.

Dump Fires. A city ordinance or other legislation should be prepared requiring private dumps which are giving the Fire Department trouble to provide an attendant and suitable fire protection on the premises. This is recommended in Chapter 5.

LAWS RELATING TO THE FIRE DEPARTMENT

Civil Service. Section 4 of Chapter 31, the State Civil Service Law, should be amended to make it possible, for Boston at least, to prescribe a maximum

¹From “Recommended Practice for the Arrangement of Building Codes,” publication of U. S. Department of Commerce, 1925.

²If Chapter 148 is revised as recommended, certain provisions relating to the tenure of office of fire chiefs in cities and towns in the metropolitan district will be affected. The recess report referred to suggests a short bill to be passed together with its revised Chapter 148, which takes care of the fire chief’s tenure of office.

age limit of 25 instead of 35 years for admission to the Fire Department. Other changes in this law, the civil service regulations or such city ordinances as may be necessary, should be prepared to provide for the recommendations of Chapter 7 of this report covering an enlistment period for privates in the Fire Department, age limits and retirement provisions for all members, and physical examinations for applicants, privates and officers.

The Technical Division. Such changes as are necessary in the city ordinances or state laws relating to Boston, should be made to provide for the Technical Division of the Fire Department proposed in Chapter 7.

Mutual Aid Law. To eliminate the present uncertainty in the matter of liability of Boston or other cities when firemen and apparatus respond to alarms outside their city limits, an amendment to Section 59 A of Chapter 48 of the General Law, is presented in Chapter 8. This should be enacted so that there will be no legal barrier to the full development of mutual aid systems.

Traffic. Chapter 7 recommends certain rules relating to parking on streets used by the Fire Department. These should be adopted by the traffic authority.

ARSON LAW

Chapter 11 recommends that the Arson Statutes (General Laws, Chapter 266, Sections 1 to 10) be brought into conformance with the so-called "Model Arson Law." A bill to do this can be readily drafted by the Law Department.

SUPERVISION OF BUILDING CONSTRUCTION IN METROPOLITAN BOSTON

The desirability of uniform building regulations in the cities of Greater Boston is obvious. The present situation, with a separate building code for each of the 40 cities and towns in the Greater Boston census area, works a great inconvenience to architects and builders who have to follow different standards in each of these communities. Many of the codes are subject to the same limitations and defects as the Boston Code which, as Chapter 2 shows, does not conform to modern standards. It is recommended therefore that the General Court authorize a commission representative of building, engineering and real estate interests to investigate the present situation in the cities and towns of Greater Boston. An appropriation should be made for this commission's work and it should, on the basis of its study, recommend a plan for a consolidation of the building departments of these cities including Boston. The work of this commission should cover the following points:

1. Uniformity of major provisions of building codes.
2. Relative value of each code as compared to modern standards.
3. Facilities for enforcement (size of staff of building department).
4. Qualifications of building officials.
5. Work of the Division of Inspections of the State Department of Public Safety and the state building laws under which that division works.

It is suggested that the commission should consist of an unpaid personnel of seven members. Of these, one might be the Building Commissioner of Boston, another be named by the Boston Board of Appeal, while the governor should appoint the remainder at large, one from Boston and the other four from the cities and towns in the metropolitan district. These men should be representative of the following general interests: architects, structural engineers, general contractors, fire underwriters, master masons or carpenters, real estate interests, and the fire and building departments of the cities.

MUTUAL AID SYSTEM

To further study mutual aid development among fire departments of cities and towns in greater Boston, the General Court should authorize a commission to survey the present situation and make recommendations for cooperation, as discussed in Chapter 8. This commission should be provided with an appropriation for clerical and other special services.

It is suggested that the commission be unpaid and made up of five members — one being the Fire Commissioner of Boston, one a representative of the New England Insurance Exchange, and three others appointed at large by the Governor from the cities and towns of Greater Boston.

CHAPTER 16

REDUCTION OF FIRE WASTE IN MASSACHUSETTS

As was indicated in Part II of this report dealing with Fire Insurance Rates in Boston, the fire loss experience of the State of Massachusetts as a whole is an important factor in the amount of fire insurance premiums which Boston is called upon to provide. It is, therefore, important to Boston that a general reduction in fire losses throughout the state be obtained.

Massachusetts has had an unfavorable fire loss record. During the past ten years the average annual fire loss in the state has been \$16,062,000.

The idea of community responsibility for fire loss has been growing steadily throughout the country in recent years and in many cities and towns local fire prevention committees of responsible business men have been formed to cooperate with the local officials in helping to correct their fire loss conditions. In nearly every instance where such committees have been created, salutary results in reduction of losses have been obtained. Every city and town in Massachusetts should have its own fire prevention committee intelligently studying and working towards the correction of its fire hazards and toward the improvement of its fire protection. A suggested organization plan for fire prevention committees is included in Appendix 16.

The State Fire Marshal could well spend a considerable part of his time working with local committees, and it seems evident that Section 49¹ of Chapter 148, General Laws, means that he should do this, making suggestions to the cities and towns of the state to improve their local facilities for controlling fires.

It is interesting to note that nearly 70 per cent. of the fire loss of Massachusetts has occurred in the thirty-six cities over 20,000 population. In contributing to these losses the following cities are the outstanding offenders: Boston, Lowell, Lynn, Cambridge, Haverhill, Chelsea, Peabody, Everett, Revere, Leominster, Gloucester, Beverly. Some of these cities are already moving to bring about a better fire loss record. Haverhill has provided a system of inspection in the fire department which has done much to cut its loss. Chelsea enjoyed its lowest loss in nine years in 1927 as the result of the establishment of an inspection force and a citizens' campaign to improve structural and housekeeping conditions. Unfortunately several of the cities in the state with unfavorable loss records have as yet made no great effort toward the improvement of their conditions. It would be greatly to their own benefit as well as to the benefit of Boston and the state if these cities would work for a reduction of their fire losses.

¹ SECTION 49. The marshal shall study fire hazard and fire prevention and all matters relating thereto, hear suggestions and complaints from all persons and from all cities and towns in the metropolitan district, advise with the officers of such cities and towns, and make suggestions to the general court and to the cities and towns looking to the improvement of the laws, ordinances and by-laws relating to fire departments, construction of buildings, building or fire limits, use and occupation of buildings and other premises, protection of existing buildings, fire escapes and other life saving devices, segregation and licensing of trades dangerous by reason of fire hazard, and all other matters relating to fire prevention and fire hazard.

APPENDICES

APPENDIX TO PART II

TABLES FURNISHED BY BOSTON BOARD OF FIRE UNDERWRITERS
GIVING TYPICAL RATES ON THE FOLLOWING CLASSES OF
PROPERTY IN NEW YORK, PHILADELPHIA, BUFFALO, PITTS-
BURGH, BALTIMORE AND BOSTON.

(See summary of this data, page 32.)

CLASS A — FIRE-RESISTIVE OFFICE BUILDINGS, UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
20	.208	.468	—	.340	.560	10	.12	.35	27	.179	.649	21	.122	.250	13	.085	.199
22	.138	.428	—	.210	.450	4	.11	.35	15	.177	.526	6	.119	.271	14	.102	.234
8	.147	.345	—	.180	.430	17	.10	.27	24	.211	.697	17	.140	.271	6	.084	.295
57	.116	.298	—	.180	.290	10	.26	.51	20	.175	.462	8	.10	.26	11	.139	.318
20	.167	.368	—	.270	.370	9	.16	.39	—	—	—	16	.10	.23	9	.123	.277
Average..	.155	.381	—	.236	.420	—	.15	.374	—	.185	.583	—	.116	.256	—	.107	.265

Grand Average: Building, .158; Contents, .378.

CLASS B — FIRE-RESISTIVE HOTEL BUILDINGS, UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
13	.395	.624	—	.40	.57	—	.26	.63	21	.299	.589	18	.17	.301	14	.177	.266
16	.158	.249	—	.27	.44	—	.29	.71	12	.315	.652	14	.168	.312	14	.250	.375
29	.119	.262	—	.25	.51	—	.25	.52	13	.489	.865	14	.147	.285	11	.320	.480
Average..	.224	.378	—	.307	.507	—	.267	.620	—	.368	.702	—	.162	.299	—	.249	.374

Grand Average: Building, .263; Contents, .480.

CLASS C — SINGLE TENANT MERCANTILE RISKS, LIGHT HAZARD — FIRE-RESISTIVE BUILDINGS, UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
5	.178	.541	—	.23	.56	—	.12	.44	4	.20	.483	—	.13	.467	7	.147	.542
5	.105	.718	—	.27	.52	—	.18	.68	4	.20	.758	—	.185	.449	5	.202	.693
5	.205	.505	—	.26	.61	—	.20	.52	6	.20	.578	—	.12	.460	5	.198	.677
Average..	.163	.588	—	.253	.563	—	.166	.546	—	.20	.606	—	.145	.459	—	.182	.637

Grand Average: Building, .185; Contents, .566.

CLASS D — SINGLE TENANT MERCANTILE RISKS, LIGHT HAZARD — NON-FIRE-RESISTIVE BUILDINGS, UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
6	.261	.64	—	.53	1.20	—	.36	1.03	4	.741	1.086	—	.518	.974	3	.46	1.51
1	.095	.687	—	.37	.77	—	.98	1.63	4	.301	.715	—	.48	.79	4	.51	1.49
1	.242	.572	—	.73	1.17	—	.58	1.02	7	.542	1.082	—	.37	.76	4	.42	1.48
Average..	.199	.633	—	.543	1.03	—	.64	1.226	—	.528	.961	—	.456	.841	—	.463	1.493

Grand Average: Building, .471; Contents, 1.03.

CLASS E — SINGLE TENANT MERCANTILE RISKS, HEAVY HAZARD — FIRE-RESISTIVE BUILDINGS, UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
2	.275	1.14	—	.81	1.05	—	.30	.73	2	.482	1.223	—	.40	.81	4	.299	.783
4	.178	.838	—	.42	.99	—	.22	.66	7	.584	1.789	—	—	—	3	.322	1.122
3	.145	.715	—	.46	.86	—	.21	.71	7	.30	.928	—	—	—	4	.296	.852
Average..	.199	.898	—	.563	.966	—	.243	.70	—	.455	1.313	—	.40	.81	—	.305	.919

Grand Average: Building, .361; Contents, .934.

CLASS F — SINGLE TENANT MERCANTILE RISKS, HEAVY HAZARD — NON-FIRE-RESISTIVE BUILDINGS, UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
2	.645	1.41	—	.65	.97	—	.58	1.18	3	.772	.970	—	1.035	1.55	5	.44	1.28
6	.776	1.61	—	.81	1.60	—	.60	1.21	3	.708	.980	—	.806	1.355	5	.46	1.51
5	1.01	1.67	—	.77	1.48	—	.55	1.17	6	.777	1.099	—	.804	1.42	8	.82	1.71
Average..	.81	1.56	—	.743	1.35	—	.578	1.18	—	.752	1.016	—	.881	1.441	—	.573	1.50

Grand Average: Building, .723; Contents, 1.34.

CLASS G — FIRE-RESISTIVE GARAGES — UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
2	.526	1.53	—	.64	.89	—	.59	.98	2	.341	1.64	—	.247	.724	1	.592	1.435
3	.555	1.32	—	.75	1.00	—	.75	1.15	2	.293	1.327	—	.330	.846	1	.567	1.392
2	.512	1.20	—	.42	.66	—	.82	1.18	9	.433	1.917	—	.375	.900	3	.583	1.36
Average..	.531	1.35	—	.603	.85	—	.72	1.10	—	.356	1.628	—	.317	.823	—	.581	1.395

Grand Average: Building, .518; Contents, 1.19.

CLASS H — WOMEN'S APPAREL — RETAIL — FIRE-RESISTIVE BUILDINGS — UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
10	.135	.726	—	.49	1.04	—	.17	.67	4	.200	.758	—	.307	.736	9	.199	.714
8	.123	.834	—	—	—	—	.18	.68	6	.275	.864	—	.24	.67	5	.207	.956
15	.209	1.05	—	—	—	—	.67	1.27	—	—	—	—	—	—	—	—	—
Average..	.155	.87	—	.49	1.04	—	.34	.873	—	.237	.811	—	.273	.703	—	.203	.835

Grand Average: Building, .283; Contents, .855.

CLASS I — WOMEN'S APPAREL — RETAIL — NON-FIRE-RESISTIVE BUILDINGS — UNSPRINKLERED

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
5	.727	2.06	—	.46	1.09	—	.38	1.05	4	.579	1.173	—	.419	.969	4	.340	1.69
4	.323	1.41	—	.42	1.08	—	.42	1.09	3	.558	1.155	—	.487	1.034	7	.71	1.83
4	.74	2.17	—	.45	1.09	—	.36	1.03	—	—	—	—	.50	1.05	5	.59	2.05
Average..	.596	1.88	—	.443	1.09	—	.386	1.05	—	.568	1.164	—	.468	1.017	—	.546	1.85

Grand Average: Building, .501; Contents, 1.34.

CLASS J — SPRINKLERED DEPARTMENT STORES — FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
11	.082	.255	—	.154	.295	—	.12	.25	—	.113	.355	—	.09	.22	9	.125	.320
14	.076	.20	—	.114	.237	—	.20	.35	—	.132	.438	—	.105	.222	9	.176	.476
10	.078	.22	—	.151	.447	—	.112	.298	—	.119	.388	—	.09	.23	8	.115	.322
4	.056	.145	—	—	—	—	—	—	—	—	—	—	—	—	10	.117	.291
12	.093	.293	—	—	—	—	—	—	—	—	—	—	—	—	8	.11	.261
Average..	.077	.222	—	.139	.326	—	.144	.299	—	.121	.393	—	.095	.224	—	.128	.334

Grand Average: Building, .117; Contents, .299.

CLASS K — SPRINKLERED DEPARTMENT STORES — NON-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
4	.169	.51	—	.38	.496	—	.18	.45	—	.433	.670	—	.18	.315	6	.27	.62
6	.142	.342	—	.326	.426	—	.22	.38	—	.573	.825	—	.265	.44	6	.225	.488
3	.126	.364	—	.462	.602	—	.153	.391	—	.586	.835	—	.175	.292	5	.327	.704
Average..	.146	.405	—	.389	.508	—	.184	.407	—	.53	.776	—	.207	.349	—	.274	.604

Grand Average: Building, .288; Contents, .508.

CLASS L — SINGLE TENANT MERCANTILE RISKS — SPRINKLERED FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
7	.065	.269	—	.061	.108	—	.10	.18	—	.10	.275	—	.09	.24	6	.08	.196
11	.059	.153	—	.529	.819	—	.113	.27	—	.167	.585	—	.10	.15	8	.074	.224
3	.045	.082	—	.069	.171	—	.22	.514	—	.138	.460	—	—	—	5	.066	.144
10	.053	.138	—	—	—	—	—	—	—	.130	.427	—	—	—	7	.065	.140
7	.049	.123	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average..	.054	.153	—	.219	.366	—	.144	.321	—	.134	.437	—	.095	.195	—	.071	.176

Grand Average: Building, .119; Contents, .275.

CLASS M — SINGLE TENANT MERCANTILE RISKS — SPRINKLERED NON-FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
3	.169	.370	—	.238	.323	—	.20	.50	—	.507	.784	—	.14	.18	6	.15	.445
7	.203	.435	—	.318	.434	—	.30	.50	—	.338	.560	—	.35	.46	5	.199	.437
6	.138	.238	—	.202	.345	—	.10	.20	—	.214	.410	—	.15	.20	5	.193	.425
5	.786	1.15	—	.12	.219	—	.32	.48	—	.260	.450	—	.25	.45	5	.36	.639
5	.123	.265	—	.294	.387	—	.19	.51	—	.350	.575	—	.32	.45	5	.222	.461
5	.153	.333	—	.177	.273	—	.23	.48	—	.410	.599	—	.30	.42	6	.20	.537
4	.224	.385	—	.512	.669	—	—	—	—	.240	.470	—	—	—	6	.08	.267
5	.232	.541	—	.241	.322	—	—	—	—	.335	.554	—	—	—	5	.41	.614
6	.147	.375	—	—	—	—	—	—	—	—	—	—	—	—	5	.257	.531
Average..	.241	.455	—	.263	.371	—	.223	.445	—	.332	.55	—	.251	.36	—	.23	.484

Grand Average: Building, .257; Contents, .444.

CLASS N — SINGLE TENANT MANUFACTURING RISKS — SPRINKLERED FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
6	.07	.175	—	.062	.137	—	.07	.12	—	.108	.323	—	.10	.21	8	.093	.177
8	.065	.232	—	.049	.085	—	.05	.11	—	.110	.310	—	.08	.18	8	.131	.562
6	.10	.236	—	.169	.252	—	.08	.13	—	.100	.180	—	.07	.18	6	.07	.16
8	.127	.772	—	.097	.310	—	—	—	—	.100	.210	—	.06	.10	10	.087	.205
5	.053	.123	—	.107	.329	—	—	—	—	.34	1.13	—	.09	.22	8	.098	.328
3	.221	.75	—	.114	.374	—	—	—	—	.10	.28	—	.12	.32	6	.054	.165
—	—	—	—	—	—	—	—	—	—	.144	.475	—	.115	.31	3	.052	.145
—	—	—	—	—	—	—	—	—	—	.100	.255	—	—	—	—	—	—
Average..	.106	.381	—	.099	.248	—	.066	.12	—	.137	.395	—	.090	.217	—	.084	.249

Grand Average: Building, .097; Contents, .270.

CLASS O — SINGLE TENANT MANUFACTURING RISKS — SPRINKLERED NON-FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
1	.627	.920	—	.194	.249	—	.08	.12	—	.141	.470	—	.31	.43	5	.226	.497
2	.186	.263	—	.452	.598	—	.27	.46	—	.442	.675	—	.68	.93	6	.13	.448
4	.676	1.00	—	.429	.574	—	.16	.30	—	.171	.570	—	.35	.70	6	.17	.38
2	.311	.549	—	1.07	1.51	—	.90	1.10	—	.172	.320	—	.18	.23	5	.067	.123
3	.494	1.06	—	.598	.838	—	.55	.65	—	.397	.625	—	.14	.19	4	.212	.676
—	—	—	—	—	—	—	.64	.76	—	1.22	1.72	—	.56	.73	4	.67	1.20
—	—	—	—	—	—	—	—	—	—	.162	.535	—	.87	1.22	4	.53	1.21
—	—	—	—	—	—	—	—	—	—	.406	.635	—	.47	.63	4	.176	.635
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	.244	.524
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	.477	.973
Average..	.458	.758	—	.548	.753	—	.433	.565	—	.389	.694	—	.445	.632	—	.29	.666

Grand Average: Building, .427; Contents, .678.

CLASS P—MULTIPLE TENANT MANUFACTURING RISKS—SPRINKLERED FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
7	.078	.22	—	.10	.273	—	.25	.40	—	.140	.415	—	.09	.18	8	.115	.456
14	.25	1.00	—	.06	.138	—	.09	.20	—	.170	.550	—	.08	.15	14	.11	.46
12	.093	.273	—	.156	.389	—	.09	.20	—	.110	.330	—	.07	.17	8	.119	.583
16	.157	.475	—	.177	.587	—	.20	.35	—	.107	.315	—	.065	.15	14	.11	.46
12	.157	.731	—	.214	.616	—	—	—	—	.10	.28	—	.07	.12	11	.127	.577
12	.31	.864	—	.135	.445	—	—	—	—	.142	.475	—	.074	.16	9	.097	.319
12	.103	.276	—	.04	.072	—	—	—	—	—	—	—	.057	.145	—	—	—
12	.267	1.08	—	.071	.132	—	—	—	—	—	—	—	—	—	—	—	—
6	.34	1.23	—	.094	.268	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	.131	.293	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	.08	.202	—	—	—	—	—	—	—	—	—	—	—	—
Average..	.195	.683	—	.114	.31	—	.157	.287	—	.128	.394	—	.072	.153	—	.113	.475

Grand Average: Building, .130; Contents, .384.

CLASS Q—MULTIPLE TENANT MANUFACTURING RISKS—SPRINKLERED NON-FIRE-RESISTIVE BUILDINGS

NEW YORK			PHILADELPHIA			BUFFALO			PITTSBURGH			BALTIMORE			BOSTON		
Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate		Height	Rate	
	Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents		Building	Contents
5	.204	.379	—	.508	.610	—	.30	.50	—	.667	1.076	—	.19	.27	6	.95	1.57
7	.203	.388	—	.472	.765	—	.80	1.22	—	.100	.210	—	.145	.25	6	.131	.487
7	1.05	1.59	—	.095	.153	—	.25	.40	—	.609	.800	—	.31	.43	6	.466	1.05
6	.241	.584	—	.821	1.08	—	.435	.53	—	.451	.685	—	.30	.42	5	.303	.819
7	.352	.753	—	.967	1.29	—	.40	.65	—	.267	.885	—	.32	.39	6	.162	.816
5	.526	1.04	—	.688	.791	—	.25	.50	—	.975	1.278	—	.33	.47	6	.205	.935
7	.615	1.07	—	.32	.396	—	.48	.94	—	.283	.490	—	.36	.49	5	.479	.882
7	.422	.689	—	.977	1.30	—	.25	.45	—	.214	.390	—	—	—	—	.179	.474
6	.713	1.22	—	.107	.159	—	.50	.90	—	—	—	—	—	—	—	.105	.175
6	.329	.532	—	—	—	—	.25	.74	—	—	—	—	—	—	—	.125	.373
5	.386	.608	—	—	—	—	1.35	2.04	—	—	—	—	—	—	—	—	—
Average..	.458	.804	—	.55	.727	—	.478	.806	—	.445	.726	—	.279	.388	—	.31	.758

Grand Average: Building, .420; Contents, .701.

APPENDIX TO PART III

APPENDIX 1

STRUCTURAL CONDITIONS AS ILLUSTRATED BY TYPICAL BLOCKS INSPECTED

By way of checking structural conditions in different parts of the city, typical blocks were inspected. Special attention was given to type of construction, kind of occupancy, protection to vertical openings in buildings and window openings between buildings, fire-stopping, and other features that would be a factor in the spread of fire.

The following descriptions will amplify the descriptive matter in Chapter 1 and illustrate the points made in Chapter 2. Specific identification of the areas inspected has been omitted.

WATERFRONT DISTRICT

A Typical Wharf. The area covered by this wharf consists of a long row of four and one half and five story, brick-walled but wooden interior buildings and two pier sheds of frame construction and very large areas unbroken by fire walls. Two fires have occurred in the pier sheds in the last two years, both of which were fortunately controlled before involving any great area.

The south pier shed can be considered as one fire area. For fire protection it is provided with one small exposed water pipe with two hydrants both offering an opportunity for connection from the water side. Somewhat within the outer end of this shed is a tin-clad frame partition with its openings barricaded by piles of barrels and boxes.

The north wing of the pier is one large frame undivided area occupied by a steamship company and a tug boat company. At the outside end of the shed there is a space used for the storage of kerosene.

Along the north side of the wharf there is a row of two-story, frame structures used largely for lobster boiling. In all of these structures the second floor is used for storage of barrels and there is a heavy concentration of flammable material. It seems to be the common practice to provide an open shaft leading to the second floor in each of these buildings, a dangerous condition in case of fire.

The row of five-story brick-walled but wooden interior buildings in the center of the wharf is divided into 40-foot areas by brick fire walls. Elevator shafts at fire walls, with openings on each side, are protected by double fire doors. The outside windows are for the most part unprotected, but four of them

have fire shutters on the north side. Fire doors between buildings were in two or three instances found blocked open. There are narrow, steep and poorly lighted open stairways in most of these buildings. In general, they contain a large amount of stock, such as cases of food supplies, bags and barrels. The lack of automatic sprinkler systems throughout the entire area makes the possibilities of heavy loss severe. In a number of these buildings the large value of contents should make the provision of a sprinkler system profitable economically.

This wharf is typical of the wharves of Boston in that it has large frame sheds in which valuable commodities are stored. In these sheds large fires and heavy losses can occur. Even the brick structures on the wharf are generally unsprinklered and in small three to five story units, the maintenance of which is usually poor. In these structures, too, vertical openings are generally unprotected so that a fire can spread throughout any one building, and the fact that in some cases fire doors between buildings were found open shows that these cannot be depended on to keep fires from spreading from one building to another.

TYPICAL TENEMENT HOUSE DISTRICTS

1. North End. The block described is generally typical of the North End district of the city. It is made up of four small blocks separated by narrow alleyways. The block consists largely of four-story and basement flats or tenements of brick-walled but wooden interior construction, each of them small in area and separated one from another generally by 12-inch brick fire walls. In these small blocks the areas are scarcely large enough to support more than one row of houses. However, two rows back to back have been built, causing severe congestion. There is practically no back-yard space and the rears of these flats are very difficult of access.

Only the basements of these tenement houses could be inspected. These were found to be very much alike. The basements are subdivided with a network of light wooden partitions forming storage rooms for the various tenants. These are for the most part kept padlocked. The basement entrances are very narrow stairs leading from the front halls. These tenements have but a single stairway inside the

building, depending on fire escapes as a secondary means of exit. Generally a single wooden door separates the front hall from the basement. There is frequently an entrance to the basement at the ground level from the small court in the rear of these buildings. In spite of these two means of access, the basements would be very difficult to get at in time of fire, as the back courts are difficult of entry and the main stairway might be involved in the fire.

Narrow alleys, together with the inner courts of the block, afford little chance to stop a fire.

The fire escapes consist either of iron stairs to the ground or horizontal escapes in the form of balconies between adjacent tenements. In some cases the balconies extend across courts. The fire escapes are generally unsatisfactory because they are almost uniformly blocked by storage, and they pass plain glass windows. If there should be a fire in any of the rooms looking out on the escapes the exit would be rendered useless.

A stable at one corner of the block presents the most serious hazard from a fire standpoint. This is a five-story brick-walled but wooden interior unplastered building. It is intended to house seventy-five horses. It is practically of one fire area, the area per floor being about 4,200 square feet. A large open elevator about 10 by 25 feet extends from the basement to the fifth floor. There are also open ramps at the front and rear of the building. In addition a large open hay chute extends from the second to the fifth floor. These various unprotected vertical openings would permit very rapid spread of fire through the whole building.

Such a building has no place in a block of this character. It is a "conflagration breeder." Nothing short of complete remodeling or a sprinkler equipment would make it reasonably safe.

The block also contained one small fire-resistive building and six or seven frame stores and dwellings.

While conditions in the North End are far from satisfactory, the density of population has a tend-

ency to reduce the chances of a fire getting very much of a start before discovery, thus lessening somewhat likelihood of loss of life.

2. West End. The block inspected is closely built, most of the structures are brick-walled, wooden interior tenements from three to five stories high. The street floors are in many cases occupied by stores. In this respect and in the general congestion of the district it is somewhat like the North End. The tenements are, however, somewhat larger individually and the streets are slightly wider.

Special hazards noted in this block include bakeries in the basements and one building occupied for rag sorting and storage. There are few frame structures. Because the block is small and closely built with tenements back to back and separated by only narrow courts, group fires are probable, as fire can rapidly spread through rear windows. The relatively small area of the individual tenements and the fact that brick walls separate most of them would make it easy for the Fire Department to control any fire in this district before it reached conflagration proportions.

The tenements have open wooden stairways, at least from the first floor to the top. A single stairway is typical with emergency exits in the form of outside fire escapes. These escapes are of questionable value because of their construction, defective condition, obstruction by miscellaneous objects stored on them, and by reason of the fact that many of them lead into rear yards or courts from which egress is difficult.

In another part of the block, there is a frame structure divided by two brick walls, but so arranged that it is practically a single fire area with stores on the first floor and tenements above. There are no fire escapes from these tenements. The basements under the stores when inspected were relatively clean, but are cut up by numerous light wooden partitions.

On one very narrow street there is a three-story building, apparently originally built as a tenement, but now occupied for rag sorting and storage. Access to all parts of this building, except one room on the second floor where men were at work sorting rags, was blocked to a greater or less degree by rags in bags and bales.

In another section there are three and four story brick tenements with stores on the first floor. The yards in the rear of these buildings may be reached only by going through the buildings themselves. There are wooden sheds and some rubbish in the yards. Fire escapes here do not lead to the ground, stopping at the second floor level or on roofs from which there is no direct access to the ground. A fire originating in this court, or in any of the buildings adjoining it, might readily spread through the windows to the half dozen or more buildings surrounding it.



A view of part of the general wholesale district and the waterfront. A large-area frame unsprinklered railway pier may be seen in the background.

A four-story building, the first story of which is used as a meeting place, contains a large amount of combustible material and is so constructed and arranged as to make probable the rapid spread of fire throughout the structure. There are no satisfactory egress facilities provided from the upper floors.

A long, narrow structure, which was closed and locked at the time of inspection, appeared to be piled with bundles of wall paper. The structure is built close to the rear of tenement buildings on all sides and constitutes a "conflagration breeder" for this block.

The likelihood of large individual fires and losses in this block is small, but the many units, relatively hazardous occupancy and generally poor maintenance provide chances for a great many fires.

3. South End. The block described is composed largely of small brick-walled but wooden interior buildings, from two to five stories in height, some buildings having stores on the first floor and tenements above. In the center of the block is a large building which was formerly a stable. The entrance to this building is from an interior court.

Beside this large building, the structures in this area are small and should involve no serious conflagration hazard. They consist largely of dwellings, two to four stories high, divided by brick walls. Some of the sections of the block are very narrow and built closely back to back so that a fire might spread rapidly from one building to another in this manner or across the narrow streets.

From the fire-fighting viewpoint the most serious feature of this area is the difficulty of access to rear courts, which, in most cases, can be reached only by passing through buildings. It would be exceedingly difficult, if not impossible, to place ladders.

The large building in this block is approximately 100 feet square and built close to the lot line on three sides, the fourth side fronting on a small court. It is a three-story and basement structure. This building is a serious fire hazard of the "conflagration breeder" type. Fire starting in it would spread rapidly throughout the structure and also spread to the residence buildings which closely adjoin it. The occupancy in the first floor is the manufacture of electric heating devices and contains the processes usual to this class of manufacture. The basement and second and third floors are not used for manufacturing operations, but for miscellaneous storage with a moderate amount of combustible material. An open elevator shaft, open disused ramps for horses, and stairways enclosed in light wooden partitions make probable the extremely rapid spread of fire throughout the building. The building is in generally poor repair, and the value of the structure is probably so small as to make adequate protection economically impracticable. It should be demolished.

Within the block there is one building completely equipped with automatic sprinklers. The occupancy of the stores in this building include second-hand clothing and furniture, a restaurant, Chinese laundry and a number of vacant stores, one of which is used for the storage of furniture. In general, the exit facilities of the tenements above these stores were inadequate.

On another street there are a few stores, a three-story sheet metal shop, and a small rear yard used for the storage of tires and other automobile junk. This structure is very old and despite a fair grade of house-keeping would readily be subject to fire which would expose the adjoining structures.

The block above described is generally typical of the miscellaneous residence and other occupancies in the South End. There is considerable congestion, as might be expected, and the residence occupancies are frequently in conjunction with stores, especially on the main streets. "Conflagration breeders" like the old stable devoted to manufacturing operations are also common.

A DISTRICT OF OLD BUILDINGS

Market District. The block described is generally typical of the market district. It consists entirely of unsprinklered brick-walled but wooden-interior buildings of small area, from 3½ to 5 stories high. The block is divided by a narrow alley. The buildings are divided largely by 12-inch brick fire walls spaced from 33 to 38 feet apart. Openings in these walls are protected by fire doors. On the alley side of the buildings tin-clad fire shutters are provided for most of the windows. Apparently, however, the majority of these shutters are kept permanently open. Because of the poor construction and lack of adequate interior protection the block is readily subject to a general fire. A brief note of conditions found in individual properties follows.

At one corner of the block is a five-story brick structure occupied on the first floor by a grocery store and a barber shop and vacant above. Fire shutters on the alley side of this building are left open. The basement of the building was found filled with cases of canned goods and groceries. An elevator shaft in this building is entirely open from top to bottom.

Next door is a poultry shop. The fourth floor is used for feather storage. A large amount of loose feathers are stored in scattered piles. Elevator doors on all floors of this building are apparently left open, it evidently not being the practice to close them even at night.

Adjoining this building is a 3½-story building used for grocery storage. There is an unprotected open shaft which extends the entire height of the building. On the third floor is heavy storage of crates. Doors to the cellar are obstructed, making access difficult.

Adjoining this building is a $3\frac{1}{2}$ -story building occupied largely as a carpenter shop, which is kept in good condition.

Next door is a $3\frac{1}{2}$ -story cheese factory, a wide open shaftway running from the first floor to the top. A large amount of loose lumber was found stored in the basement. The boiler room in the basement was well protected with the exception of an ordinary wooden door instead of a fire door. The door of the cellar was partly blocked by a heavy table.

A corner building is a $3\frac{1}{2}$ -story structure used as a wholesale grocery. Heavy storage of cases and boxes was noted on each floor. Passageway to the windows was found blocked. This building is unheated.

Adjoining this building is a $3\frac{1}{2}$ -story structure used as a commission house. The top floor of this building is vacant, but contains a considerable amount of rubbish.

In a spring bed factory an open shaftway runs from the entrance to the fourth floor. This is unprotected on the second floor.

A $4\frac{1}{2}$ -story crate factory containing a very large amount of crates and other wooden materials stored on each floor was inspected. The building is unheated except for the office. Its floors are well kept and aisle space between stock is well maintained.

This block shows the small unit properties, and the general lack of protection to vertical openings in the buildings which would allow fires to spread rapidly from basement to the top floor.

DISTRICTS WHERE VALUES ARE CONCENTRATED

1. General Wholesale District. The block inspected is occupied largely by wholesale clothing houses, some of which do light manufacturing. The block is entirely of brick-walled but wooden interior construction and practically all structures are protected by automatic sprinklers.

There is one very large area six-story and basement building occupying practically the entire block. The building has two fire walls, but nearly two-thirds of it is undivided except for frame partitions. The windows facing the inner court of this block are all well protected by tin-clad shutters in good condition. The windows facing the street are for the most part, however, unprotected. The two freight elevators are protected from the inside by fire doors, but have plain glass windows on the street side. Staircases are open from top to bottom, but the passenger elevators are enclosed. The building is protected by an automatic fire alarm system as well as the sprinklers.

This block is typical of the general wholesale district in that the buildings are generally sprinklered. Areas are frequently large, however, and vertical shafts, stairways, etc., are not properly enclosed, so that a fire can spread from one floor of a building to another. In unsprinklered portions of this block there have been at least two very large fires and generally through-

out the wholesale district large fires are possible in the unsprinklered buildings. Losses are likely to be high even in the sprinklered property because of the numerous tenants whose stock may be damaged by water.

Other typical occupancies of this district are wool and cotton warehousing and shoe and leather storage. Frequently manufacturing operations also are performed. A great many of the buildings house several business concerns, so that in case of fire the loss is seldom limited to one concern.

2. Central Retail District. The district contains theaters, large department stores, small novelty and specialty stores and some office buildings. The block described was selected because it illustrates the variety of construction and occupancy.

Along one side are various small retail stores mostly devoted to women's clothing. There is one large fire-resistive building occupied by a department store. The buildings are mostly brick-walled with wooden interiors and five stories in height, the larger area ones being protected by automatic sprinklers. Most of the buildings in this group, however, are small units of approximately 2,000 square feet area. This part of the block is narrow and accessible from a boundary street and an alley way which limits the danger of communicating fires. Most of the buildings are cut off from each other by fire walls without openings.

The rest of the block is an unusually large area, which is divided by a new fire-resistive theater which extends through the center of the block. With the



A narrow street in the wholesale leather district which has been the scene of many severe fires and heavy losses.

exception of a vacant hotel building, the block is now generally a good one. In addition to the theater mentioned there are two fire-resistive structures on diagonally opposite corners. Throughout the block there are a number of automatic sprinkler systems. The stage sections of the various theaters are also protected with sprinklers. The vacant hotel is an eight-story brick-walled but wooden interior building of large area and entirely open from the basement to the top story. A building of such very poor construction, large area and unprotected interior openings is out of place in this high value congested area.

MANUFACTURING DISTRICTS

1. Tenant Manufacturing District in South End. A long, brick and wood building with four stories and basement, sprinklered, covered practically the entire area of the block inspected. This building is occupied by various woodworking plants. The other structure in the block is a new but not a fire-resistive building, built in 1925, occupied on the lower floors by woodworkers and on the third and fourth floors as a shoe factory.

One end of this block has brick walls and wood floors on unprotected steel or wood beams, with unprotected iron, or in some cases wood, columns. The group of buildings is divided into sections with fire doors at various floors and, as has been noted, is equipped with automatic sprinklers. The fire doors between sections of these buildings were frequently found blocked open by stock piled against them, and in a good many cases the automatic closing device on the doors was found out of order so that they were practically worthless as fire stops. The Fire Department would have no assurance on going into this building that the fire might be kept from spreading from one section to another by the proper operation of these doors. The doors between sections could be of some value as horizontal exits in case of fire, but some were found locked and would thus be of no value in this respect. With the exception of a fire escape at one end of the block, there is no emergency exit worthy of the name on any part of this building. The usual hazards of woodworkers are present in this block. While housekeeping conditions were generally good in one section of this block, they were only fair elsewhere.

The boiler room of this plant is hazardous. There are two chutes which feed shavings and sawdust directly to the boilers and a chute which empties shavings directly on the floor in front of the boiler. There are several chutes which empty into receptacles or on to the floor adjacent to the boiler room. Although there are fire shutters on two openings between the boiler room and the basement these doors are in poor condition and were found wedged open.

The most serious defect, however, is that the part of the basement referred to is not equipped with

automatic sprinklers as is the rest of the building. There is evidence of at least one fire already in this basement.

The new building at the corner is well equipped with exits, having two enclosed stairways, but the shoe factory is crowded with workers and there are gates on the stairways at landings. These may or may not be easy to open in case of a panic and should be done away with. The shoe factory extends from this building to part of the older building previously described, the fire doors between the sections, however, being in good working order.

While this building is a relatively new one, it is of substantially the same construction as the older building in the rest of the block. It has brick walls, wood floors supported on steel I beams and is a very unsatisfactory type of building from a fire standpoint, as a little fire can cause distortion if not collapse of the unprotected steel frame work.

Most of the land at the rear of this building is vacant. At one corner there is lumber stored in the vacant lot which exposes the near-by woodworking plants.

The block described is typical of the tenant manufacturing properties in this section of the South End. Although the tenant properties are sprinklered, the lack of attention to other important details for the protection of hazards and general inferior building construction make conditions bad. The possibilities of large fires in case of failure of the sprinkler protection are obvious.

2. Mixed Occupancy in South End. The block described is fairly representative of its general neighborhood which is devoted to large, and for the most part single tenant manufacturing plants.

This block contains a few tenements, a manufacturer of office furniture, several lumber yards, a brass foundry and brass and iron worker and a candy factory. Facing one street there are three buildings, stores and tenements of four-story brick and wood construction.



A South End tenement surrounded on three sides by a lumber yard. This is typical of the miscellaneous character of the South End.

One was vacant and very dirty. In another a weaver was using rags on the first floor and in the basement. A high frame fence surrounded the back yard of the three buildings making access to the rear very difficult.

At one end of the block is an office furniture factory. This building is two to three stories of brick walled but wooden interior construction. Part of the building used for storage is unsprinklered.

On the second floor of the building used for glueing operations and the storage of wood and furniture, an automatic fire door was found which would not operate. Shavings are chuted three floors to the boiler room where they empty on to the floor. The boiler room fire door was wedged open. Except for these defects, this woodworking plant is in good shape, but would be improved by the extension of sprinklers through the entire building, and by the protection of windows on one side.

Next door is a lumber yard, a fire in which would do very serious damage to this building. Because the exposure is severe, the windows should be not only protected by wired glass in metal frames or fire shutters, but should have open sprinklers for a water curtain.

The lumber yard occupies a considerable area of the block. The lumber is piled in orderly fashion and housekeeping appears to be good. The property is a very serious hazard, however, because it contains such a large amount of easily combustible material.

Next to the lumber yard are several tenements, four-story, of brick and wood construction. These are severely exposed by the lumber yard and the fenced-in condition of the back yards which abut the lumber yard would help to spread a fire.

Adjacent to the tenements is a second-hand building material yard and a large two-story frame lumber shed. This adds a great deal to the amount of combustible material in the area.

The brass foundry appears to be well supervised as to fire protection details, is completely sprinklered and has no unusual hazards. It has severe exposures, but its openings are well protected. There is a third lumber yard adjacent to the brass foundry.

At the end of the block is a candy factory which although of ordinary brick and wood construction, is adequately provided with exits, having an enclosed fire resistive stairway on one end and a wood enclosed stairway at the other. The building is unsprinklered. It is well kept, however, and partitions are of metal lath and plaster.

This block is typical of concentrated values and hazards. The lumber storage yard can probably contribute to as large a fire as is ordinarily possible anywhere in the city.

OUTLYING RESIDENTIAL DISTRICTS

Two residential districts outside the congested district were selected for description. Both of these are typical of the districts in their general locality, but

were particularly chosen for inspection because there seems to be more fires and losses in the general neighborhood of these blocks than elsewhere in the outlying residential parts of the city.

1. A "Three-Decker" District. This block is made up primarily of 26 three-story frame apartments, each housing three families, built in two rows. Thirty-five and 50 feet separates the rear piazzas and the buildings are about 10 to 15 feet apart on the street front. The buildings are frame joist with either shingled or clapboarded sides. The roofs are a flat type with incombustible coverings. The interior finish is wood lath and plaster except for metal lath and plaster on ceilings directly over the heating plants.

The block also contains at one end a short row of one-story and basement miscellaneous retail stores.

Egress from all the dwellings is by either a front or rear stairway leading directly to the outside. At the first floor landings of the back stairway one door leads to the outside and a single panelled door leads to the basement. Under ordinary conditions the exit facilities of these types of buildings are adequate.

The wood lath and plaster sheathing at the ceilings of the basements was generally in poor condition. This was most serious around chimneys, behind the main electrical switchboard, at the drains from ice chests located on the upper floors, and around soil pipes. In numerous cases rapid spread of fire would be possible from these openings to the concealed places, and it is a serious condition that has been brought about by light, cheap construction and poor plumbing arrangements. Such conditions are responsible for the rapid spread of fire from basements of these buildings to the upper floors. The wood lath and plaster finish is cheaply installed with the thinnest of plaster coating and would be of little aid in checking the spread of any fire.

The basements of the stores were separated from one another by poorly matched, single boarded partitions with an 8-inch brick wall at the middle.



A row of frame "three-deckers" in a part of Dorchester where the frequency of fires is high.

The only access to these basements is through trap doors in the rear of the stores. The windows at the front of the basement are only about 10 inches high and it is through these that the Fire Department would have to make use of cellar pipes in attempting to extinguish fire. The wooden partitions make it easy for the fire to spread, but would hamper the distribution of water by the Fire Department.

The three deckers in this section are built farther apart than in some others, but in spite of this there is a considerable conflagration hazard, due to the frame construction of practically all the buildings.

2. A Brick Apartment District. The block described is typical. The apartments are of the duplex type with two families on each floor, separated only by wooden partitions. The buildings are anywhere from 5 to 15 feet apart and fire can readily spread from one to another. Roofs are of tar and



A group of brick and wood "duplex" apartments in a part of Roxbury in which there have been a number of serious fires and losses.

gravel. All of the windows are of plain glass. The following construction details were noted in the basements.

In an apartment on one corner, the basement ceiling is wood lath and plaster sheathed on wood joist, and is in poor condition. The ceiling is broken by and around drains from ice chests, which would promote rapid spread of fire from the basement to the upper floors. The building has two stairways which are open from one floor to another. The stairs from the basement, however, are cut off by single boarded doors leading to the first floor. The stairways are enclosed in ordinary partitions of wood lath and plaster.

The apartment next door is likewise equipped with two stairways, the door from the basement at the rear being cut off with a fire door; but at the time of the inspection it was found open and without any automatic closing device. A defect of the back stairway is that occupants using it as an exit to the outside must necessarily pass through several apartments or go through the basement. Fire in the basement would rapidly spread up this rear stairway, and as there is an open corridor between the two stairways of each floor, smoke would also be likely to fill the corridor leading to the front stairs. Direct exit to the outside should therefore be provided for this rear stairway.

The other apartments are similar to those already described, having poorer exit arrangements than the ordinary three-decker frame apartments and about the same facilities to spread fire through the building.

In one apartment the basement was found to be in very poor condition. At one time it had been finished for servants' quarters, but all the rooms are now in a very dilapidated condition. The wood floors have rotted away and plaster is falling from the walls and ceilings.

APPENDIX 3 A

TOTAL NUMBER OF ALARMS, 1918-1927

From Fire Department Annual Reports

YEAR	Total Fires	"Needless" Alarms	False Alarms	Other Alarms	Total Alarms
1918.....	4,173	618	271	112	5,174
1919.....	4,353	575	382	113	5,423
1920.....	3,728	530	110	117	4,485
1921.....	4,408	620	127	92	5,247
1922.....	5,179	543	169	243	6,134
1923.....	6,071	729	287	154	7,241
1924.....	6,600	870	332	191	7,993
1925.....	6,205	996	405	96	7,702
1926.....	6,310	1,044	420	96	7,870
1927.....	6,021	883	314	114	7,332

APPENDIX 3 B

TOTAL NUMBER OF FIRES, 1918-1927

From Fire Department Annual Reports

YEAR	Fires in Buildings	Fires in Brush, Rubbish, Etc.	Automobile Fires	Other Fires	Total Fires
1918.....	2,507	1,206	142	318	4,173
1919.....	2,763	1,064	202	324	4,353
1920.....	2,373	795	236	324	3,728
1921.....	2,696	1,117	233	362	4,408
1922.....	2,927	1,534	281	437	5,179
1923.....	3,148	2,034	364	525	6,071
1924.....	3,699	1,948	444	509	6,600
1925.....	3,539	1,575	409	682	6,205
1926.....	3,766	1,584	535	425	6,310
1927.....	3,379	1,648	583	411	6,021

See Fig. 64, Chapter 3.

APPENDIX 3 C

MISCELLANEOUS MINOR LOSSES, 1918-1927

As Reported by Boston Protective Department in its Annual Reports

YEAR	Marine Losses	Rent Losses	Sprinkler Leakage	Water Damage Other Than In Fires
1918.....	\$5,503	\$13,959	\$22,663	\$5,662
1919.....	142,300	3,501	16,383	13,936
1920.....	141,750	3,963	49,680	26,160
1921.....	2,068	6,958	16,379	11,531
1922.....	14,536	12,553	22,707	8,897
1923.....	14,120	22,912	19,670	7,089
1924.....	77,145	12,476	46,144	12,991
1925.....	45,224	22,454	34,144	10,707
1926.....	31,487	37,487	28,458	12,184
1927.....	232,730	9,957	20,930	7,862
Totals.....	\$706,863	\$146,220	\$277,158	\$117,019
Average Annual Loss.....	\$70,686	\$14,622	\$27,716	\$11,702

APPENDIX 3 D

FIRE LOSSES AS REPORTED BY BOSTON PROTECTIVE DEPARTMENT

1927	Insured Losses	Losses Not Insured	Total Losses
Losses on Buildings.....	\$1,928,108.41	\$62,582.07	\$1,990,690.48
Losses on Contents.....	1,573,686.00	130,265.21	1,703,951.21
Total.....	\$3,501,794.41	\$192,847.28	\$3,694,641.69
Per Cent.....	94.8	5.2	100

For the most part, the losses reported to the Boston Protective Department are those actually paid by insurance companies, plus a figure, partly an estimate, for that proportion of the losses not covered by insurance. The 1927 totals as reported by the Department are given above.

The foregoing table shows that the so-called "uninsured losses" are only a small per cent of the total and that the Protective Department loss figures may be taken to be actual losses paid by insurance companies.

"Uninsured Losses". The method of arriving at the figure for uninsured losses is not well understood. They amount to only about 5 per cent. of the total losses. Uninsured losses may include losses upon which no insurance is carried or so-called "co-insured" losses. When a partial loss is sustained by an assured whose property is insured at a reduced "contribution clause" rate, these co-insurance losses are mathematically figured.

The Back Bay Station fire of 1928 furnishes a good example of how uninsured losses are determined and is submitted below:

Estimated Replacement Cost.....	\$1,082,843.58
Less estimated replacement value of undamaged portion.....	662,909.45
Estimated replacement value of damaged portion.....	\$419,934.13
Less depreciation as agreed.....	104,983.53
Actual fire loss.....	\$314,950.60
Insurance carried on property.....	200,000.00
"Uninsured loss".....	\$114,950.60

The amounts given after the various items were arrived at by the insurance adjusters co-operating with the railroad engineers.

Losses on "No Loss" Fires in Buildings. The Protective Department apparently does not estimate an "uninsured loss" except where a part of the loss is covered by insurance. In 1927, 1,103 fires in buildings had no loss paid by the insurance companies and consequently no estimate of "uninsured loss" by the Protective Department. On 479 or nearly half of these fires the Fire Department made an estimate of loss which totalled \$36,147. This shows that the Protective Department's estimate of uninsured losses is necessarily a little below the actual losses assumed by the owners of property themselves.

APPENDIX 4 A

RECORD OF AUTOMATIC SPRINKLERS

FIVE YEARS, 1923-1927

As Reported by Boston Protective Department

NUMBER OF SPRINKLERS OPERATING	Total Number of Fires	Per Cent.
1.....	529	55.5
2.....	187	19.7
3.....	76	8.0
4.....	37	3.9
5.....	23	2.4
6.....	26	2.7
7.....	18	1.9
8.....	8	.8
9.....	12	1.2
10.....	8	.8
Over 10.....	30	3.1
Total.....	954	100.0

APPENDIX 4 B

RECORD OF AUTOMATIC SPRINKLERS

TEN YEARS, 1918-1927

As Reported by Boston Protective Department

FLOOR ON WHICH SPRINKLER HEAD OPERATED	Number of Fires	Per Cent.
Sub Basement.....	24	1.6
Basement.....	505	34.6
First Floor.....	256	17.6
Second Floor.....	159	10.9
Third Floor.....	140	9.6
Fourth Floor.....	147	10.1
Fifth Floor.....	126	8.7
Sixth Floor.....	65	4.5
Seventh Floor.....	13	.9
Eighth Floor.....	10	.7
Ninth Floor.....	2	.8
Tenth Floor.....	1	
Eleventh Floor.....	1	
Pent House on Roof.....	5	
Outside (Paper Bins).....	2	
Totals.....	1,456	100.0

In only 24 fires the heads operated on more than one floor.

APPENDIX 4 C

CAUSES OF FIRES IN RESIDENCE
BUILDINGS, 1927

As Given in Fire Department Reports

Fires due to heating apparatus:	
Chimney fires (soot burning).....	245
Overheated or defective chimney or stove pipe.....	110
Sparks from chimney (on wooden roof)...	68
Hot ashes in contact with combustible material.....	66
Overheated or defective stove, boiler, or furnace.....	39
Rubbish in contact with hot pipes, fur- naces, etc.....	30
Kerosene stoves, starting fires with kero- sene or gasolene.....	26
Fuel oil burners.....	14
	— 598
Assigned to careless smoking.....	307
Children and matches.....	165
Other fires assigned to careless use of matches.....	264
	— 736
Defective electric systems.....	73
Defective gas systems.....	21
	— 94
Incendiary or suspicious.....	58
Food on stove igniting.....	69
Clothes or furniture near fire or flame.....	59
Spontaneous combustion.....	43
Fireworks.....	23
Use of flammable liquids for cleaning, etc.....	20
Thawing frozen water pipes.....	8
Miscellaneous known causes.....	102
Unknown.....	174
Total.....	1,984

APPENDIX 4 D

CAUSES OF FIRES IN BUILDINGS OTHER
THAN RESIDENCES, 1927

As Given in Fire Department Reports

Fires due to heating apparatus:		
Chimney fires (soot burning).....	93	
Defective flues, chimneys or stove pipes..	66	
Defective stoves, furnaces or boilers.....	39	
Sparks from heating appliances on com- bustible material.....	38	
Defective fuel oil burners.....	34	
Rubbish in contact with hot pipes, stoves, furnaces, etc.....	17	
Hot ashes in contact with combustible material.....	15	
	—	302
Assigned to careless smoking.....	293	
Children and matches.....	36	
Other fires assigned to matches.....	65	
Awning fires (generally assigned to careless smoking or careless use of matches)....	37	
	—	431
Fires due to electricity:		
Short circuit.....	90	
Heating units (including irons).....	16	
Static.....	6	
	—	112
Fires caused by, or assigned to, spontaneous combustion.....	106	
Sparks from machines.....	47	
Open flame near flammable liquids.....	13	
Open flame near combustible material.....	17	
	—	30
Incendiary.....	45	
Grease or food on stove igniting.....	35	
Fires in buildings under construction.....	7	
Thawing water pipes.....	3	
Miscellaneous known causes.....	100	
Unknown.....	186	
Total.....		1,404

APPENDIX 4 E

CAUSES OF FIRES WITH LOSSES EXCEEDING
\$15,000 PER FIRE

FIVE-YEAR PERIOD, 1923-1927

RESIDENCE BUILDINGS

CAUSE	Number of Fires
Unknown.....	15
Defective wiring.....	3
Defective chimney.....	1
Spark from electric switch igniting flammables,	1
Gas stove igniting woodwork.....	1
Hot ashes.....	1
Incendiary.....	1
Children and matches.....	1
Explosion — unknown.....	1
Rubbish near furnace.....	1
	—
Total.....	26

NON-RESIDENTIAL BUILDINGS

CAUSE	Number of Fires
Unknown.....	208
Smoking.....	16
Defective wiring.....	6
Spontaneous combustion.....	4
Defective chimney or smoke pipe.....	4
Suspicious.....	3
Hot ashes.....	2
Sparks from machines.....	2
Overheated iron.....	2
Sparks from tug boat.....	1
Overheated gas stove.....	1
Fat boiling over.....	1
Friction spark.....	1
Defective electric motor.....	1
Matches.....	1
Acetylene torch.....	1
Static electricity.....	1
Incendiary.....	1
Turpentine fumes igniting.....	1
	—
Total.....	257

APPENDIX 4F

AREAS OF HIGH FIRE FREQUENCY (OUTSIDE OF CONGESTED DISTRICT)

(Summarized from Figs. 96 and 97, Chapter 4. See, also, Fig. 209, Chapter 12)

1. **Charlestown.** (Fire District 2.)
 - (a) North of Water Street to Henley Street, between Wapping Street and City Square.
 - (b) East of Rutherford Avenue, to Main Street, between Austin and Middlesex Streets.
 - (c) Junction of Main, Medford, Bunker Hill Streets and Rutherford Avenue.
2. **East Boston.** (Fire District 1.)
 - (a) Along Meridian Street, from Maverick to Central Square, spreading west along Summer and Maverick Streets.
 - (b) Along Lexington and Princeton Streets, from Meridian to Brooks Street.
 - (c) Cottage and Lubec Streets, branching off slightly west on Summer and Everett Streets.
3. **South Boston.** (Fire District 6.)
 - (a) Southeast from Dorehester Street, between Champney and East Ninth Streets.
 - (b) Northeast of Old Colony Avenue, along E Street and Tudor and Sixth Streets.
 - (c) In the triangular section between Dorehester Avenue and A Street.
 - (d) Northwest of Dorchester Street, between Broadway and First Street.
 - (e) Northwest of Dorehester Street, in the vicinity of E and F Streets, between Broadway and Fifth Street.
 - (f) Block bounded by I, K, East Third and East Second Streets.
 - (g) East Fifth and East Sixth Streets, between L and I Streets.
4. **Brighton.** (Fire District 11.)
 - (a) North of Brighton Avenue to Gardner Street and Farrington Avenue.
 - (b) Vicinity of Union Square.
 - (c) Market Street, between Surrey Street and Mount Vernon Street.
5. **South End.** (Fire District 7.)
 - (a) Albany Street to Harrison Avenue, between Warcham and Brookline Street.
 - (b) Washington Street west to Tremont Street, between Massachusetts Avenue and the Railroad, with heaviest frequency along Washington Street and Dover Street.
6. **Roxbury.** (Fire District 7.)
 - (a) Tremont Street and Columbus Avenue, between Ruggles Street and Davenport Street.
 - (b) Generally through the section from Roxbury Street to Camden Street, between Washington and Tremont Streets.
 - (c) Tremont Street, along Massachusetts Avenue to the Railroad, and west to Camden Street.
7. **Fenway.** (Fire District 8.)
 - (a) Massachusetts Avenue west to Hemenway Street, from St. Stephen Street to Boylston Street.
 - (b) Triangular shaped district bounded by Huntington Avenue, Parker and Smith Streets.
8. **Outlying Sections.**
 - (a) Blue Hill Avenue, from Seaver Street to Clifford Street, with general spread from Blue Hill Avenue in the vicinities of Gaston and Holborn Streets, and at Quiney Street near Mascoma Street.
 - (b) General vicinity of Morton and Blue Hill Avenue.
 - (c) Dorchester Avenue (east side), from Geneva Avenue to Savin Hill Avenue.

APPENDIX 4 G

CHIMNEY FIRES, 1927

FIRES AND LOSSES BY MONTHS

MONTH	RESIDENTIAL BUILDINGS		OTHER BUILDINGS		TOTAL	
	Number of Fires	Losses	Number of Fires	Losses	Number of Fires	Losses
January	40	\$90	18	\$ 0	58	\$90
February	38	179	15	0	53	179
March	28	60	14	80	42	140
April	27	0	13	0	40	0
May	11	0	3	5	14	5
June	6	0	1	0	7	0
July	5	0	1	0	6	0
August	3	0	3	0	6	0
September	8	15	0	0	8	15
October	13	10	3	0	16	10
November	25	50	10	65	35	115
December	41	50	12	2	53	52
Totals	245	\$454	93	\$152	338	\$606

APPENDIX 4 H

CHIMNEY FIRES, 1927

BY FIRE DISTRICTS

FIRE DISTRICT	Residential Buildings	Other Buildings	Total
1	10	1	11
2	8	1	9
3	0	5	5
4	14	10	24
5	4	10	14
6	19	4	23
7	40	27	67
8	34	17	51
9	27	7	34
10	23	2	25
11	24	3	27
12	18	2	20
13	8	0	8
14	5	4	9
15	11	0	11
Totals	245	93	338

APPENDIX 5 A

OUTDOOR FIRES BY MONTHS, 1927

(Not Including Automobiles or Miscellaneous Fires
Outdoors)

MONTH	Rubbish Fires Around Build- ings	Grass and Brush Fires	Dump Fires	Fires in Vacant Lots
January.....	5	1	11	16
February.....	4	19	10	6
March.....	24	240	31	24
April.....	58	366	61	60
May.....	12	16	10	11
June.....	46	19	33	81
July.....	29	8	29	37
August.....	10	3	20	14
September.....	20	4	33	27
October.....	14	20	28	19
November.....	11	48	16	13
December.....	11	120	6	19
Totals.....	244	864	288	327

APPENDIX 5 B

CAUSES OF GRASS AND BRUSH FIRES, 1927

CAUSES GIVEN	Total	Per Cent.
Probably Set by Boys.....	353	40.8
Set by Boys.....	239	27.7
Cigarettes — Smoking.....	115	13.2
Sparks from Chimney.....	8	0.9
Careless use of Matches.....	7	0.8
Spark from Locomotive.....	80	9.3
Citizen Burning over Land.....	28	3.5
Short Circuit of Transmission Line,	1	.0
Unknown.....	33	3.8
	864	100.0

Data from Fire Department Reports.

APPENDIX 5 C

HOW BRUSH AND GRASS FIRES WERE
EXTINGUISHED, 1927

DATA FROM FIRE DEPARTMENT REPORTS

	Total	Per Cent.
Brooms.....	269	31.1
Brooms and Shovels.....	7	1.0
Brooms and Watering Pots.....	169	19.5
Brooms and Water Pails.....	28	3.2
Hand Extinguishers.....	11	1.3
Hand Extinguishers and Brooms...	37	4.3
Chemical Stream.....	27	3.0
Hydrant Stream.....	262	30.2
Engine Stream.....	33	4.0
Put out by Citizen before Arrival of Department.....	19	2.2
Put out by Police.....	1	0.1
Fire Burnt Out.....	1	0.1
Totals.....	864	100.0

54.7 per cent. of these fires were controlled with nothing more than brooms (occasionally shovels), water pails and watering pots.

APPENDIX 5 D

LOCATION OF FIRES IN DUMPS AND
VACANT LOTS, 1927
By FIRE DISTRICTS

FIRE DISTRICT	Dump Fires	Fires in Vacant Lots	Total
1.....	45	18	63
2.....	1	9	10
3.....	0	0	0
4.....	0	7	7
5.....	0	4	4
6.....	6	20	26
7.....	1	5	6
8.....	3	138	141
9.....	39	33	72
10.....	26	11	37
11.....	11	34	45
12.....	5	20	25
13.....	38	5	43
14.....	97	22	119
15.....	16	1	17
Totals.....	288	327	615

APPENDIX 5 E

DUMPS WHICH HAD THREE OR MORE
FIRES, 1927

FIRE DISTRICT	Dump	Location	Number of Fires
14.....	Hallet Street.....	Along Milton Branch, N. Y., N. H. & H. R.R., near Neponset Bridge,	52
	East Boston Land Co. Dumps.....		45
1.....	Westbrook Street..	Off Bennington Street, near Old Colony Branch, N. Y., N. H. & H. R.R. (21 fires).	
1.....	Prescott and Orleans Streets (21 fires).		
1.....	Harmony Street (3 fires).		
14.....	Pope's Hill Street...	Off Neponset Avenue, near Old Colony Branch, N. Y., N. H. & H. R.R.....	34
9.....	Robinson Court.....	Foot of Savin Hill Avenue, near Rapid Transit, N. H. Robinson...	30
10.....	Victory Road.....	Off Neponset Avenue, near Freeport Street...	16
13.....	Weld Street.....	Near Centre Street and Arboretum.....	13
14.....	River Street.....	Consumptives' Hospital, near Midland Division N. Y., N. H. & H. R.R.....	10
13.....	564 Hyde Park Ave..	Between Neponset Avenue and Hadwin Way,	8
13.....	Morton Street.....	State Hospital.....	7
9.....	Mt. Vernon Street...	Boston Street and Columbia Road.....	6
15.....	East Milton Street...	Off Westville Road.....	4
13.....	Granfield Avenue....	From 4070 Washington Street.....	4
11.....	Western Avenue.....	Near bridge and Cambridge.....	4
11.....	Lake Street.....	Brighton Avenue, near Kendrick Street.....	3
9.....	Davitt Street.....	Foot of Savin Hill Avenue, N. W. Robinson..	3
			239
	11 Dumps having 2 fires each.....		22
	27 Dumps having 1 fire each.....		27
	Total.....		288

APPENDIX 5 F

VACANT LOTS WHICH HAD THREE OR MORE
FIRES, 1927

FIRE DISTRICT	Location	Number of Fires
8.....	Rear 101 Ward Street.....	4
1.....	Lovell and Frankfort Streets...	3
8.....	Rear 218 Parker Hill Avenue....	3
8.....	Rear 183 Roxbury Street.....	3
8.....	Centre and Cedar Streets.....	3
8.....	Opposite 43 Lawn Street.....	3
12.....	Centre Street, opposite Lamar-tine Street.....	3
		22
	20 vacant lots which had 2 fires each.....	40
	265 vacant lots which had 1 fire each.....	265
	Total.....	327

APPENDIX 5 G

FIRES IN DUMPS AND VACANT LOTS, 1927

HOW FIRES WERE EXTINGUISHED

As Reported by Boston Fire Department

HOW EXTINGUISHED	No. Fires
Extinguishers, no data as to kind:	
1 extinguisher.....	22
2 extinguishers.....	1
3 extinguishers.....	5
Unknown number of extinguishers.....	3
1 Foam type extinguisher.....	1
1 Soda-acid type extinguisher.....	2
1 Carbon tetrachloride extinguisher.....	3
2 Carbon tetrachloride extinguishers.....	1
Pails of water or watering pots.....	20
Shovels (plus brooms in 1 case).....	3
Brooms.....	6
Hand hose.....	1
Chemical stream (plus extinguishers in 2 cases, brooms in 1 case).....	61
2 Hydrant or Pump Streams (plus deck gun in 1 case).....	2
Hydrant or Pumper stream (plus chemical stream in 7 cases, watering pots and brooms in 2 cases, small line in 2 cases and extinguishers in 1 case, plus deck gun in 7 cases).....	465
Stream from locomotive.....	1
Attendant with hose.....	2
Sand and dirt.....	3
Stamped out.....	1
Burned out.....	4
Put out by rain.....	1
No services by department.....	1
No data.....	6
Total.....	615

APPENDIX 5 H

AUTOMOBILE FIRES, 1927

In 1927 the Boston Fire Department responded to 608 fires in automobiles on the street. These caused a total loss of \$31,747. Study of the causes of the fires showed that while defective wiring was a common source of ignition, that leaking gasoline due to carelessness during filling operations or breaks in the gasoline supply piping was the primary factor involved. In a number of cases smokers set upholstery afire.

Most of the fires were small, averaging \$50. Large losses occurred in valuable cars and a few loaded trucks.

Of the 608 fires, 301 or nearly half of them were put out with hand extinguishers.

Recommendations. 1. Owners of fleets of automobiles, trucks especially, should be encouraged to keep their motors clean and to periodically inspect the wiring.

2. The record reaffirms the necessity for close attention to business when filling automobile gasoline tanks and the need for careful handling of gasoline around filling stations.

3. Owners should equip their cars with one or more portable fire extinguishers of a type labelled by Underwriters' Laboratories.

APPENDIX 5 I

SPECIAL CALLS WHERE THERE WAS NO
FIRE, 1927

As Reported by Boston Fire Department

CAUSE OF ALARM	Number of Alarms
Smoke mistaken for fire.....	335
Largely needless calls.....	146
Calls reasonably justifiable.....	113
Rescue work.....	69
Flame or light mistaken for fire.....	67
Steam mistaken for fire.....	34
Automobiles supposed to be on fire.....	20
Accidental alarms due to testing alarm boxes, etc.....	18
Hot water heating systems.....	14
Not enough detail to classify.....	47
Total.....	863

APPENDIX 5 J

BOXES FROM WHICH FALSE ALARMS ARE
FREQUENTLY PULLED

List of Boxes pulled three times or oftener during
the period May 1, to November 22, 1928.

POLICE DIVISION	Location of Box
1. North End.....	Barrett and North Streets. Snow and Hall Streets.
2. Business District.	None.
3. West End.....	None.
4. Business District.	None.
5. South End.....	None.
6. South Boston.....	Dorchester Avenue and A Street. C Street, at West Seventh Street. D Street, at Gold Street.
7. East Boston.....	Everett and Jeffries Street. Frankfort and Gove Streets. Paris and Gove Streets. London and Maverick Streets. Marion and Chelsea Streets. Chelsea and Curtis Streets.
8. Harbor.....	None.
9. Roxbury.....	Southampton and Atkinson Streets. Palmer and Albany Streets. Gerard and Kemble Streets. Rockland Avenue and Rockland Street. East Cottage and Batchelder Streets. Holborn and Weldon Streets. Perth and Quincy Streets. Lawrence and Mascoma Streets.
10. Roxbury.....	Westminster and Sterling Streets. Shawmut Avenue and Vernon Street. Smith and Phillips Streets. Tremont and Parker Streets. Lambert Street and Lambert Avenue. Hillside and Wait Streets. South Huntington Avenue, between Ever- green and Floyd Streets. Minden and Lawn Streets. Minden and Day Streets. Chestnut and Forbes Streets. Lamartine and Hoffman Streets. Centre and Amory Streets. Highland and Marcella Streets. Heath and Malden Streets.
11. Dorchester.....	Harbor View and Sydney Streets. Grampian Way and Evandale Terrace. Olney and Blakeville Streets. Robinson and Draper Streets. Everett and Park Streets. Green Hill and Blanche Streets. Park and Adams Streets. Oakley and Bowdoin Streets. Park and Marlowe Streets. Dix and Lafield Streets. Train Street and Munroe Terrace. Ocean and Burt Streets. Englewood and Adams Streets. Butler and Adams Streets.
12. City Point.....	L Street and Marine Road.
13. Jamaica Plain.....	Cornwall Street and Brookside Avenue.
14. Brighton.....	Mt. Vernon and Foster Streets. Brentwood and Athol Streets.
15. Charlestown.....	Medford and Pearl Streets. Medford and Cottage Streets. Rutherford Avenue and Devens Street Water and Hudson Streets. Medford and Decatur Streets.
16. Back Bay.....	None.
17. West Roxbury.....	None.
18. Hyde Park.....	None.

The activities in Charlestown, East Boston and possibly South Boston were due to persons on foot, whereas it appears that those operating in Roxbury and Dorchester have worked to a large extent from automobiles, particularly in Dorchester. This is deduced from the fact that in Charlestown, East Boston and South Boston the distances between boxes pulled were relatively small as compared to those in Roxbury and Dorchester, where some transportation would be needed to conveniently make the rounds of the boxes pulled.

APPENDIX 5 K

FALSE ALARMS BY POLICE DIVISIONS

POLICE DIVISION	1927	May 1 to November 22, 1928
1.....	3	17
2.....	1	2
3.....	2	6
4.....	1	6
5.....	6	15
6.....	3	30
7.....	13	48
8.....	0	0
9.....	32	76
10.....	56	97
11.....	41	119
12.....	2	34
13.....	25	30
14.....	57	37
15.....	16	55
16.....	2	5
17.....	41	22
18.....	10	9
19.....	25	44
Totals.....	336	652

APPENDIX 6 A

BOSTON FIRE LOSSES, 1898-1927

As Given in Annual Reports of the Fire Department

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1898				
January	\$37,920	\$26,875	\$64,795	41.5
February	37,039	36,300	73,339	49.5
March	30,992	36,235	67,227	52.4
April	156,308	233,185	389,493	59.9
May	17,279	62,770	80,049	78.5
June	16,237	10,329	26,566	38.9
July	55,613	258,475	314,088	82.1
August	20,792	47,926	68,718	69.7
September	30,191	136,211	166,402	82.0
October	11,709	13,215	24,924	53.0
November	19,555	22,426	41,981	53.4
December	24,927	65,081	90,008	72.4
Totals	\$458,562	\$949,028	\$1,407,590	67.5
1899				
January	\$19,402	\$79,064	\$98,466	80.4
February	51,709	58,396	110,105	53.0
March	79,687	152,217	231,904	65.5
April	146,881	208,368	355,249	58.6
May	46,750	29,689	76,439	38.9
June	75,248	70,028	145,276	48.1
July	55,435	101,209	156,644	64.8
August	52,762	53,859	106,621	50.5
September	16,645	19,666	36,311	55.6
October	18,123	10,693	28,816	37.1
November	48,632	60,330	108,962	55.4
December	58,056	140,150	198,206	70.8
Totals	\$669,330	\$983,669	\$1,652,999	59.5
1900				
January	\$35,493	\$40,123	\$75,616	53.0
February	41,402	75,645	117,047	64.6
March	67,740	133,066	200,806	66.5
April	23,792	13,840	37,632	36.8
May	41,168	118,128	159,296	74.0
June	25,445	42,121	67,566	62.2
July	81,599	327,212	408,811	80.0
August	42,837	82,488	125,325	65.6
September	41,547	48,323	89,870	54.4
October	14,555	50,181	64,736	77.5
November	19,755	30,845	50,600	60.8
December	64,689	206,533	271,222	76.4
Totals	\$500,022	\$1,168,505	\$1,668,527	70.0

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1901				
January	\$51,142	\$58,164	\$109,306	52.1
February	66,633	137,059	203,692	67.5
March	52,892	175,778	228,670	76.6
April	56,968	209,230	266,198	78.5
May	39,656	97,425	137,081	71.0
June	30,324	51,877	82,201	63.1
July	152,348	76,981	229,329	33.6
August	9,517	20,428	29,945	68.2
September	17,483	46,617	64,100	72.6
October	21,562	59,253	80,815	73.4
November	65,806	68,481	134,287	51.0
December	42,474	87,945	130,419	67.4
Totals	\$606,805	\$1,089,238	\$1,696,043	64.2
1902				
January	\$62,983	\$180,639	\$243,622	74.2
February	90,384	166,821	257,205	64.8
March	44,996	75,116	120,112	62.6
April	22,970	21,769	44,739	48.6
May	41,812	78,465	120,277	65.1
June	26,002	51,890	77,892	66.6
July	49,778	114,268	164,046	69.8
August	17,707	25,454	43,161	57.7
September	41,085	34,995	76,080	46.0
October	14,545	18,147	32,692	55.5
November	26,076	39,613	65,689	60.2
December	106,612	261,463	368,075	71.0
Totals	\$544,950	\$1,068,640	\$1,613,590	66.2
1903				
January	\$110,203	\$282,448	\$392,651	71.6
February	29,299	37,924	67,223	56.5
March	23,912	22,036	45,948	47.9
April	107,868	136,580	244,448	55.9
May	43,391	90,190	133,581	67.5
June	47,880	134,340	182,220	73.7
July	42,038	33,210	75,248	44.1
August	126,714	162,798	289,512	56.0
September	31,166	98,238	129,404	75.9
October	31,696	84,057	115,753	72.7
November	38,922	44,929	83,851	53.5
December	73,723	107,134	180,857	59.3
Totals	\$706,812	\$1,233,887	\$1,940,699	63.6
1904				
January	\$65,880	\$60,408	\$126,288	47.8
February	112,511	288,482	400,993	72.1
March	39,335	87,028	126,363	68.8
April	25,762	28,034	53,796	52.0
May	44,668	39,469	84,137	47.0
June	24,845	52,483	77,328	67.9
July	406,275	33,860	440,135	7.7
August	22,301	14,389	36,690	39.2
September	94,204	139,578	233,782	59.5
October	79,137	145,276	224,413	64.8
November	237,872	296,110	533,982	55.5
December	73,028	73,878	146,906	50.2
Totals	\$1,225,818	\$1,258,995	\$2,484,813	50.5

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1905				
January	\$54,473	\$60,982	\$115,455	52.8
February	251,685	94,131	245,816	27.2
March	41,816	43,621	85,437	51.1
April	25,558	30,705	56,263	54.6
May	56,640	133,161	189,801	70.0
June	24,676	40,073	64,749	61.8
July	136,777	168,921	305,698	55.3
August	81,284	70,547	151,831	46.5
September	24,948	51,457	76,405	67.4
October	53,782	129,969	183,751	70.6
November	89,160	95,334	184,494	51.6
December	130,964	158,712	289,676	54.8
Totals	\$971,763	\$1,077,613	\$2,049,376	52.5
1906				
January	\$70,991	\$125,234	\$196,225	63.9
February	37,073	52,702	89,775	58.7
March	45,291	73,004	118,295	61.6
April	60,413	26,769	87,182	30.7
May	22,312	62,041	84,353	73.5
June	29,330	38,095	67,425	56.5
July	18,280	19,598	37,878	51.8
August	25,291	36,185	61,476	58.8
September	27,341	31,049	58,390	53.1
October	12,521	13,399	25,920	51.6
November	48,671	59,896	108,567	55.0
December	138,955	109,125	248,080	44.0
Totals	\$536,469	\$647,097	\$1,183,566	54.6
1907				
January	\$42,327	\$100,666	\$142,993	70.0
February	144,039	209,679	353,718	59.2
March	49,051	54,572	103,623	52.2
April	44,368	93,832	138,200	67.8
May	32,989	49,947	82,936	60.2
June	45,023	32,117	77,140	41.6
July	89,874	161,976	251,850	64.3
August	95,589	159,510	255,099	62.5
September	80,504	211,509	292,013	72.4
October	39,005	61,097	100,102	61.1
November	31,775	43,853	75,628	58.0
December	78,983	137,006	215,989	63.5
Totals	\$773,527	\$1,315,764	\$2,089,291	63.0
1908				
January	\$136,995	\$184,781	\$321,776	57.5
February	71,358	81,421	152,779	53.3
March	47,448	128,347	175,795	73.3
April	187,105	47,545	234,650	20.2
May	43,045	62,679	105,724	59.4
June	23,846	51,651	75,497	68.5
July	649,144	746,761	1,395,905	53.5
August	14,332	18,415	32,747	56.3
September	78,267	145,846	224,113	65.0
October	56,312	69,498	125,810	55.3
November	59,118	82,357	141,475	58.1
December	108,867	95,097	203,964	46.5
Totals	\$1,475,837	\$1,714,398	\$3,190,235	53.8

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1909				
January.....	\$425,000 ¹	\$315,000 ¹	\$740,000	42.5
February.....	45,937	87,743	133,680	65.6
March.....	54,564	104,143	158,707	65.6
April.....	35,265	89,080	124,345	71.6
May.....	41,639	101,509	143,148	71.0
June.....	51,140	117,646	168,786	69.6
July.....	31,894	24,407	56,301	43.4
August.....	33,169	17,536	50,705	34.6
September.....	19,387	15,776	35,163	44.8
October.....	224,155	126,215	350,370	36.1
November.....	40,756	71,450	112,206	63.5
December.....	66,070	74,729	140,799	53.3
Totals.....	\$1,068,976	\$1,145,234	\$2,214,210	51.8
1910				
January.....	\$152,751	\$53,284	\$206,035	25.9
February.....	213,088	194,382	407,470	47.6
March.....	210,208	528,772	738,980	71.6
April.....	73,802	104,296	178,098	58.5
May.....	40,254	78,970	119,224	66.1
June.....	34,395	26,122	60,517	43.1
July.....	44,277	71,276	115,553	61.7
August.....	278,139	611,235	889,374	68.7
September.....	55,213	59,910	115,123	52.0
October.....	42,205	38,336	80,541	47.5
November.....	41,081	66,301	107,382	61.6
December.....	77,115	270,525	347,640	77.0
Totals.....	\$1,262,528	\$2,103,409	\$3,365,937	62.3
1911				
January.....	\$63,327	\$101,375	\$164,702	61.5
February.....	75,963	143,942	219,905	65.4
March.....	68,255	69,607	137,862	50.5
April.....	74,705	202,262	276,967	73.0
May.....	48,704	67,317	116,021	58.0
June.....	31,360	78,876	110,236	71.6
July.....	90,579	115,274	205,853	56.0
August.....	51,157	48,609	99,766	48.8
September.....	122,302	208,848	331,150	63.0
October.....	21,667	31,039	52,706	58.8
November.....	36,529	61,327	97,856	62.6
December.....	77,380	282,059	359,439	78.5
Totals.....	\$761,928	\$1,410,535	\$2,172,463	65.0
1912				
January.....	\$260,417	\$181,961	\$442,378	41.1
February.....	76,010	116,450	192,460	60.5
March.....	112,973	265,907	378,880	70.1
April.....	76,376	120,016	196,392	61.0
May.....	69,800	107,098	176,898	60.5
June.....	88,891	89,408	178,299	50.0
July.....	119,909	143,186	263,095	54.4
August.....	56,570	93,778	150,348	62.5
September.....	34,855	58,537	93,392	62.6
October.....	44,367	82,737	127,104	65.1
November.....	50,068	72,339	122,407	59.0
December.....	81,643	121,469	203,112	59.9
Totals.....	\$1,071,879	\$1,452,886	\$2,524,765	57.6

¹ See footnote, page 282.

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1913				
January	\$72,163	\$139,025	\$211,188	65.8
February	172,335	391,345	563,680	69.5
March	128,677	242,756	371,433	65.3
April	54,406	84,413	138,819	60.6
May	189,334	346,950	536,284	64.7
June	127,096	145,676	272,772	53.3
July	125,232	123,305	248,537	49.8
August	46,068	77,444	123,512	62.6
September	63,892	105,639	169,531	62.2
October	23,983	29,375	53,358	55.0
November	50,300	130,323	180,623	72.1
December	105,343	163,290	268,633	60.6
Totals	\$1,158,829	\$1,979,541	\$3,138,370	63.0
1914				
January	\$180,067	\$225,570	\$405,637	55.3
February	204,448	162,353	366,801	44.2
March	153,315	206,468	359,783	57.5
April	131,233	155,594	286,827	54.4
May	104,399	189,354	293,753	64.5
June	93,092	153,122	246,214	62.1
July	41,855	63,347	105,202	60.0
August	84,302	72,918	157,220	46.3
September	38,264	45,298	83,562	54.1
October	53,606	85,474	139,080	61.5
November	162,674	229,217	391,891	58.6
December	72,818	104,481	177,299	59.0
Totals	\$1,320,073	\$1,693,196	\$3,013,296	56.3
1915				
January	\$105,762	\$185,879	\$291,641	63.8
February	60,518	144,877	205,395	70.6
March	199,100	385,431	584,531	66.0
April	136,063	202,079	338,142	59.8
May	74,638	50,023	124,661	40.1
June	66,442	159,035	225,477	70.6
July	54,451	55,438	109,889	50.4
August	40,547	68,561	109,108	62.9
September	71,788	69,616	141,404	49.2
October	107,486	193,435	300,921	64.1
November	71,542	275,321	346,863	79.3
December	101,208	118,947	220,155	54.0
Totals	\$1,089,545	\$1,908,642	\$2,998,187	63.6
1916				
January	\$240,848	\$161,622	\$402,470	40.2
February	135,722	207,281	343,003	60.3
March	162,444	177,319	339,763	52.3
April	90,386	75,168	165,554	45.4
May	94,328	188,628	282,956	66.5
June	43,966	55,380	99,346	55.8
July	39,016	43,557	82,573	52.9
August	29,079	29,383	58,462	50.2
September	22,847	44,703	67,550	66.0
October	47,493	65,096	112,589	57.9
November	94,192	151,976	246,168	61.8
December	71,223	100,832	172,055	58.6
Totals	\$1,071,544	\$1,300,945	\$2,372,489	55.0

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1917				
January	\$244,245	\$463,480	\$707,725	65.5
February	349,169	469,673	818,842	57.8
March	67,284	131,785	199,069	66.0
April	58,672	116,435	175,107	66.5
May	84,108	149,604	233,712	64.0
June	48,556	144,477	193,033	74.6
July	51,564	57,589	109,153	53.1
August	47,692	512,372	560,064	91.4
September	35,610	55,857	91,467	61.2
October	67,593	133,816	201,409	66.8
November	62,827	198,232	261,059	75.9
December	168,408	262,179	430,587	61.0
Totals	\$1,285,728	\$2,695,499	\$3,981,227	67.7
1918				
January	\$155,289	\$307,127	\$462,416	66.5
February	154,110	205,955	360,065	57.1
March	48,343	45,269	93,612	48.4
April	157,679	210,342	368,021	57.3
May	83,869	121,570	205,439	60.5
June	79,416	167,450	246,866	67.8
July	50,869	36,681	87,550	41.9
August	49,226	22,326	71,552	31.8
September	32,830	41,121	73,951	55.5
October	55,760	60,500	116,260	52.0
November	132,644	195,409	328,053	59.6
December	295,237	113,088	408,325	27.7
Totals	\$1,245,272	\$1,526,838	\$2,822,110	54.0
1919				
January	\$185,500	\$346,536	\$532,036	65.2
February	123,523	173,659	297,182	58.5
March	53,413	26,994	80,357	33.6
April	43,348	53,876	97,224	55.4
May	78,850	176,514	255,364	69.2
June	48,560	25,145	73,705	34.1
July	62,248	76,362	138,610	55.1
August	24,042	26,669	50,711	52.7
September	38,239	43,028	81,267	53.0
October	148,172	180,493	328,665	55.0
November	71,907	95,838	167,745	57.1
December	155,503	173,906	329,409	52.8
Totals	\$1,033,314	\$1,398,970	\$2,432,284	57.5
1920				
January	\$184,035	\$139,471	\$323,506	43.1
February	107,337	165,904	273,241	60.7
March	196,655	360,170	556,825	64.7
April	71,887	103,816	175,703	59.1
May	25,412	43,446	68,858	63.0
June	129,782	487,083	616,865	78.9
July	94,653	108,368	203,021	53.4
August	49,742	85,963	135,705	63.3
September	37,726	44,805	82,531	54.3
October	38,819	96,737	135,556	71.3
November	40,714	126,388	167,102	75.6
December	68,288	190,615	258,903	73.6
Totals	\$1,045,050	\$1,952,766	\$2,997,816	65.1

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1921				
January	\$290,389	\$355,547	\$645,936	55.0
February	157,822	460,564	618,386	74.5
March	147,154	400,740	547,894	73.0
April	100,100	258,377	358,477	72.0
May	119,874	110,513	230,387	48.0
June	135,405	446,117	581,522	76.7
July	70,272	78,946	149,218	52.8
August	55,192	52,911	108,103	48.9
September	69,477	120,962	190,439	63.4
October	85,882	59,564	145,446	41.0
November	60,696	76,970	137,666	55.9
December	122,095	172,563	294,658	58.5
Totals	\$1,414,358	\$2,593,774	\$4,008,132	64.7
1922				
January	\$138,935	\$176,522	\$315,457	56.0
February	135,711	240,398	376,109	63.8
March	127,784	329,766	457,550	72.0
April	66,594	134,618	201,212	67.0
May	82,800	143,240	226,040	63.4
June	83,727	381,949	465,676	82.0
July	86,337	119,963	206,300	58.3
August	76,754	86,779	163,533	53.0
September	30,932	38,466	69,398	55.5
October	48,747	65,496	114,243	57.4
November	118,610	176,979	295,589	59.7
December	217,493	195,989	413,482	47.4
Totals	\$1,214,434	\$2,090,161	\$3,304,595	63.2
1923				
January	\$352,376	\$926,530	\$1,278,906	72.5
February	261,481	296,948	558,429	53.1
March	154,211	164,614	318,825	51.6
April	164,474	448,916	613,390	73.3
May	186,487	391,834	578,321	67.9
June	68,195	64,714	132,909	48.8
July	206,459	1,366,903	1,573,362	86.5
August	59,045	70,581	129,626	54.5
September	43,250	55,604	98,854	56.3
October	79,120	116,223	195,343	59.5
November	205,794	288,753	494,547	58.4
December	151,534	162,254	313,788	51.5
Totals	\$1,932,426	\$4,353,874	\$6,286,300	69.4
1924				
January	\$328,885	\$336,966	\$665,851	50.6
February	301,497	375,103	676,600	55.4
March	181,951	482,173	664,124	72.6
April	147,293	166,541	313,834	53.1
May	90,018	147,220	237,238	62.0
June	137,419	140,889	278,308	50.6
July	106,001	301,679	407,680	74.0
August	144,891	219,971	364,862	60.3
September	55,260	67,724	122,984	55.1
October	111,910	102,637	214,547	47.8
November	128,017	130,089	258,106	50.3
December	193,333	332,028	525,361	63.2
Totals	\$1,926,475	\$2,803,020	\$4,729,495	59.3

YEAR AND MONTH	Losses on Buildings	Losses on Contents	Total Losses	Per Cent. Contents to Total
1925				
January.....	\$434,332	\$579,588	\$1,013,920	57.2
February.....	146,133	331,330	477,463	69.4
March.....	203,462	157,263	360,725	43.6
April.....	191,071	255,435	446,506	57.0
May.....	276,329	284,651	560,980	50.7
June.....	225,119	195,863	420,982	46.5
July.....	179,807	137,746	317,553	43.4
August.....	237,705	191,286	428,991	44.5
September.....	93,749	100,352	194,101	51.7
October.....	161,517	131,385	292,902	44.5
November.....	171,938	107,495	279,433	38.5
December.....	293,686	319,827	613,513	52.1
Totals.....	\$2,614,848	\$2,792,221	\$5,407,069	51.7
1926				
January.....	\$272,092	\$451,148	\$723,240	62.4
February.....	298,397	213,721	512,118	41.8
March.....	225,920	326,445	552,365	59.2
April.....	143,868	127,771	271,639	47.1
May.....	189,709	201,705	391,414	51.5
June.....	141,039	242,856	383,895	63.3
July.....	309,064	426,383	735,447	57.9
August.....	177,042	222,125	399,167	55.6
September.....	130,390	77,245	207,635	37.2
October.....	84,416	56,034	140,450	39.9
November.....	201,254	153,774	355,028	43.3
December.....	290,004	237,563	527,567	45.0
Totals.....	\$2,463,195	\$2,736,770	\$5,199,965	52.6
1927				
January.....	\$260,403	\$301,483	\$561,886	53.6
February.....	111,042	103,222	214,264	48.1
March.....	202,904	153,220	356,124	43.0
April.....	285,550	320,402	605,952	52.7
May.....	132,264	121,048	253,312	47.8
June.....	227,815	169,163	396,978	42.6
July.....	90,517	123,361	213,878	57.5
August.....	102,469	77,918	180,387	43.1
September.....	82,489	35,139	117,628	29.9
October.....	137,010	94,096	231,106	40.6
November.....	158,273	70,759	229,032	30.9
December.....	199,947	134,140	334,087	40.1
Totals.....	\$1,990,683	\$1,703,951	\$3,694,634	46.1

¹ *Re* January, 1909, figure: The reported figure for this month is an estimate of \$740,000 covering both buildings and contents. Of this loss, the Park Square Station loss took up \$600,000, leaving about \$140,000 loss from normal fire reasons. The usual January loss is approximately 3/7 buildings and 4/7 contents. On this basis the estimated losses for January, 1909, are placed at \$425,000 on buildings and \$315,000 on contents after making allowances for excess of building over contents in the station loss of \$600,000.

APPENDIX 6 B

EXTRAORDINARY INDIVIDUAL FIRES WHICH GIVE PART EXPLANATION OF FIRE LOSSES
TOTALING OVER \$500,000 A MONTH

As Given in Annual Reports of Fire Department

		1908	Loss
July 8.	East Boston Pier, Cunard Wharf Co., <i>et al</i>		\$1,310,280
		1909	
Jan. 7.	Park Square Station, N. Y. N. H. & H. R. R., <i>et al</i>		600,000
		1910	
Mar. 5.	194-200 Summer Street, The Boston Rubber Supply, <i>et al</i>		326,730
Mar. 12.	439 Albany Street, Boston Elevated Railway Co.		270,296
Aug. 9.	350 Albany Street, Blacker & Shepard and Repair Shop of Fire Dept., <i>et al</i>		364,411
Aug. 18.	169-181 Congress Street, Crimmins & Pierce, <i>et al</i>		334,001
		1913	
Feb. 20.	239-249 Causeway Street, Braman, Dow & Co.		280,644
Feb. 26.	Off Beverly Street, Boston & Maine Railroad		131,033
May 10.	Mystic Wharf, Export Lumber Co.		194,364
		1917	
Jan. 29.	77-111 Chauncy Street, Thomas Kelley & Co. <i>et al</i>		507,662
Feb. 2.	78-86 Purchase Street, Fort Hill Storage Warehouse, <i>et al</i>		50,136
Feb. 6.	559 Atlantic Avenue, E. W. Nash & Co., <i>et al</i>		90,129
Feb. 10.	50 Exeter Street, Hotel Lenox		94,712
Feb. 21.	1622 Washington Street, Loew Enterprise Co., <i>et al</i>		257,676
Feb. 22.	176 South Street, American Oak Leather Co., Inc.		135,853
Aug. 24.	341 Congress Street, Quincy Market Cold Storage & Warehouse		480,712
Dec. 18.	83-89 Broad Street, Southgate Press, <i>et al</i>		103,137
Dec. 23.	381-389 Congress Street, Boston Scale & Machine Co., <i>et al</i>		123,107
		1919	
Jan. 12.	38-42 Damrell Street, S. A. Woods Machine Co.		219,041
Jan. 21.	166-174 Summer Street, Hub Shoe Co., <i>et al</i>		188,994
		1920	
Mar. 25.	451-463 Atlantic Avenue, Crocker Pen Co., <i>et al</i>		228,696
June 3.	232-240 Purchase Street, Foss & Co., <i>et al</i>		525,237
		1921	
Jan. 1.	87-93 Albany Street & 73 Harvard Street, Standard Bottling & Extract Co.		113,136
Jan. 2.	332 A Street, Crown Cork & Seal Co., <i>et al</i>		75,602
Jan. 16.	400 Washington Street, Brighton Congregational Church		88,418
Feb. 21.	481-483 Neponset Avenue, Boston Elevated Railway, <i>et al</i>	Neponset Carhouse	277,532
Mar. 4.	Amory Street, Boston Elevated Railway, <i>et al</i>	Amory St. Carhouse	369,864
June 28.	67-71 South Street, A. C. Ratchesky, <i>et al</i>		430,501
		1922	
Mar. 25.	Rear of 81 Wareham Street, Gordon Supply Co., <i>et al</i>		170,560
June 10.	168-170A Street, Blake, Boas, & Kelligrew <i>et al</i>		302,888

1923		Loss
Jan. 14.	63 Mt. Vernon Street, H. M. Sweet, <i>et al.</i>	\$105,250
Jan. 20.	73-75 South Street and 170-180 Essex Street, L. Schapiro Shoe Co., <i>et al.</i>	150,646
Jan. 22.	118-128 Lincoln Street, R. E. MacDonald, <i>et al.</i>	598,816
Apr. 14.	185-187 State Street and 82-84 Central Street, The Kelley Peanut Co., <i>et al.</i>	175,035
Apr. 25.	116-124 Merrimae Street, H. Traiser & Co., Inc.	103,710
May 2.	217-219 State Street and 114 Central Street, Webster Thomas Co., <i>et al.</i>	340,816
July 18.	374-394 Congress Street, Thomas Kelly Co., <i>et al.</i>	1,269,300
Nov. 17.	209-211 State Street, The Murray Co., <i>et al.</i>	123,072
1924		
Jan. 15.	1337 Federal Street, Slaters Shoe Co., <i>et al.</i>	168,976
Feb. 26.	104-114 Lincoln Street, Brooks Shoe Co., <i>et al.</i>	107,027
Mar. 5.	167-173 Summer Street, Bluestein Bros., <i>et al.</i>	100,032
Mar. 11.	69-71 High Street and 227-229 Purchase Street, G. H. Wahn Co., <i>et al.</i>	86,532
Mar. 13.	107 South Street, C. G. Flynn Leather Co., <i>et al.</i>	113,943
Dec. 16.	1230-1240 River Street, Myer Dana, <i>et al.</i>	75,628
Dec. 26.	38 Kemble Street, H. E. Gibby, <i>et al.</i>	51,816
Dec. 26.	332 A Street, R. W. Redding Estate, <i>et al.</i>	70,777
1925		
Jan. 13.	30-38 Summer Street, The Kennedy Co., <i>et al.</i>	227,092
Feb. 8.	322-328 Washington Street and 1-11 Milk Street, F. L. Dunne & Co., <i>et al.</i>	172,725
Apr. 19.	503-509 Medford Street, S. M. Howes Co., <i>et al.</i>	158,168
May 8.	1-21 So. Market Street, Boston Fruit & Produce Exchange Co., <i>et al.</i>	201,952
June 17.	337 Marginal Street, Booth Fisheries Co.	75,926
June 22.	93 & 95 Border Street, Manson Lumber Co., <i>et al.</i>	108,401
Aug. 29.	18-24 Atlantic Avenue, Post Publishing Co., <i>et al.</i>	219,502
1926		
Jan. 6.	332-340 Summer Street, Kistler, Lesh & Co., Inc., <i>et al.</i>	267,103
Mar. 13.	63 Long Wharf, M. L. Hall Co., <i>et al.</i>	143,501
May 3.	104-114 Lincoln Street, Burtman, Rondeau Co., <i>et al.</i>	143,139
July 23.	80 Border Street, Atlantic Works, <i>et al.</i>	342,758
Aug. 18.	28-30 Canal Street and 27-29 Merrimae Street, William Leavens & Co., <i>et al.</i>	196,595
1927		
Jan. 13.	531-537 Albany Street, Gordon Supply Co., <i>et al.</i>	152,245
1928		
Jan. 6.	65 Tolman Street, Coffin Valve Co.	137,571
Apr. 15.	145 Dartmouth Street, N. Y. N. H. & H. R. R., <i>et al.</i>	360,359
Apr. 28.	26-28 Pittsburgh Street, Colonial Can Co., <i>et al.</i>	152,934

BACK Bay Station

APPENDIX 6 C

STATISTICAL METHODS EMPLOYED IN CHAPTER 6

1. Deflation of Original Data. Before deflating the original data, as obtained from the Annual Reports of the Boston Fire Department (Appendix 6 A) it was necessary to determine the most suitable indexes of price fluctuations to deflate the building losses and the contents losses separately.

For the deflation of contents losses, the Index of Wholesale Prices of Commodities of the United States Bureau of Labor Statistics was chosen since it covered some 400 general items and would be applicable, therefore, to the vast majority of items listed under contents losses.

The index used for deflating the building losses series was made up of two series, first the United States Bureau of Labor Statistics Index of Wholesale Prices of Building Materials from January, 1898, to October, 1915, and thereafter the Engineering News-Record Index of Construction Costs, both indexes obtained from the bulletins of the Bureau. The Index of Wholesale Prices of Building Materials moves in the same general trend as the Engineering News-Record Index of Construction Costs but is different with regard to extent of movement and the recent level on which it has rested. This is considered to be due to the labor factor which is not included in the Bureau's Price Index but which is weighted 38 per cent. in the Engineering News-Record Index. That wages have remained at a generally proportionate higher level since 1920 than have commodity prices is generally accepted, when a comparison with pre-war years is made. Thus it was decided that a more accurate deflation of the original data was obtainable by using the Engineering News-Record Index in preference to the Bureau Price Index.

The point of change was taken as of November first, 1915, at which time both indexes were at the same point. It was not until after this period that the two indexes exhibited divergences in movements or extent of movement.

The actual deflation of the data was carried through by dividing the dollar losses of each month for the buildings losses and the contents losses by the respective index for each month. The total deflated losses were obtained by adding the deflated building losses to the deflated contents losses.

2. Determination of Secular Trends. In examining the plotted monthly deflated values, no definite curvilinear trend was apparent. The losses over the entire period seemed to center about a horizontal trend line. Accordingly it was decided that a straight line trend would be suitable in analyzing the series, and such trend lines were fitted to the three series by the method of least squares, using the equation $y = a + bx$.

The solutions of the three equations are as follows:

$$\begin{aligned} \text{Losses on Buildings} \dots\dots y &= 79.02216 - .00975 x \\ \text{Losses on Contents} \dots\dots y &= 111.99531 + .06142 x \\ \text{Total Losses} \dots\dots\dots y &= 189.37640 + .95639 x \end{aligned}$$

As shown by Fig. 117 (chapter 6) and by the solutions to the equations, the trends exhibited a very narrow movement for the thirty-year period, making it unnecessary to eliminate the trend influences, so ordinates of trend for each month were not computed.

In order to relate the fluctuations of the data to a base line, the following base lines were assumed, being the trend ordinates for January, 1913, in each case:

Losses on Buildings.....	\$77,000
Losses on Contents.....	123,000
Total Losses.....	200,000

The data for each series was then related to the respective base line.

3. Determination of Seasonal Variation. The actual monthly loss values of the deflated series were tabulated to show the range from the lowest monthly value to the highest. These values were then arranged in class intervals of \$10,000 for buildings, and \$20,000 for contents and total losses, in order to obtain a frequency distribution of the losses of each month for each of the series. These frequency distributions were then plotted on arithmetic probability paper in order to obtain the median values for each month of the several series. Considerable skewness was found to exist in the majority of these frequency distributions. To obtain the median figures which would represent the most typical loss figure for each month, smooth curves were drawn through each frequency distribution curve. These adjusted median values were further adjusted in order to make their total equal to 1,200 so that the average monthly loss figure of each index would be 100.

4. Cyclical Fluctuations. To obtain the cyclical fluctuations, the deflated data of each series were related to the corresponding base line. The resulting monthly values were then divided by the corresponding indexes of seasonal variation to eliminate the seasonal influences. This procedure left the actual cyclical fluctuations which showed, however, a considerable extent of fluctuation from month to month. To eliminate this situation, and also to eliminate irregular influences, seven months' moving averages of each series were computed for use in the text of the report.

In order to make comparisons with the Harvard "B" curve, which is expressed in units of one standard deviation, one further step was necessary in connection with the fire loss series. The standard deviation of this series was determined and the actual fluctuations above or below the base line of zero determined. Once again seven months' moving averages were computed to give smoother curves of more use in comparative analysis than the actual monthly cyclical deviations.

APPENDIX 8

FIRE LOSSES IN GREATER BOSTON,¹ 1918-1927

The figures presented in the following table include:

1. Fire losses in Boston proper. Figures from Boston Protective Department.

2. Fire losses in the cities and towns over 20,000 population. Figures as reported by the respective Fire Departments to the National Board of Fire Underwriters.

Cambridge	Malden	Waltham
Somerville	Medford	Revere
Lynn	Chelsea	Watertown
Quincy	Brookline	Arlington
Newton	Everett	Melrose

3. Fire losses in the cities and towns which, together with the above, are included in the Metro-

politan Fire Prevention District. Figures as reported to the State Fire Marshal.

Woburn	Saugus	Reading
Belmont	Winchester	Stoneham
Winthrop	Milton	Lexington

4. Fire losses in the cities and towns in the Greater Boston area, but not included in the Metropolitan Fire Prevention District. Figures as reported to the State Fire Marshal.

Weymouth	Needham	Cohasset
Wakefield	Swampscott	Hull
Dedham	Hingham	Westwood
Braintree	Canton	Nahant
Wellesley	Weston	Dover

SUMMARY OF FIRE LOSSES IN GREATER BOSTON

CITY OR TOWN	1927			FIVE-YEAR AVERAGE, 1923-1927		
	Population	Losses	Per Capita Loss	Average Population	Average Losses	Per Capita Loss
GROUP 1						
Boston.....	799,000	\$3,694,642	\$4.62	784,200	\$5,064,714	\$6.46
GROUP 2						
Cambridge.....	120,000	\$455,671	\$3.79	116,600	\$539,645	\$4.63
Somerville.....	105,000	206,027	1.96	100,600	265,112	2.63
Lynn.....	104,000	686,621	6.60	103,200	654,438	6.34
Quincy.....	64,000	134,841	2.11	59,000	130,767	2.21
Newton.....	55,000	85,287	1.55	52,000	113,736	2.19
Malden.....	54,000	126,318	2.34	52,600	101,227	1.92
Medford.....	52,000	146,983	2.83	49,600	106,008	2.14
Chelsea.....	50,000	182,740	3.65	48,400	316,207	6.54
Brookline.....	47,000	155,914	3.32	44,000	115,002	2.62
Everett.....	42,000	212,150	5.05	42,600	243,783	5.72
Waltham.....	37,000	123,793	3.35	34,600	79,650	2.30
Revere.....	36,000	303,430	8.44	34,200	202,444	5.92
Watertown.....	31,000	43,929	1.41	27,400	63,162	2.31
Arlington.....	30,000	52,582	1.75	26,210	79,740	3.04
Melrose.....	22,000	61,198	2.78	20,470	50,859	2.48
Total of Group 2.....	849,000	\$2,977,484	\$3.50	810,480	\$3,061,780	\$3.78
GROUP 3						
Woburn.....	19,100	\$331,026	\$1.73	18,404	\$208,521	\$11.33
Belmont.....	17,000	18,379	1.08	15,241	33,913	2.22
Winthrop.....	16,500	61,643	3.73	16,168	62,482	3.86
Milton.....	14,260	37,700	2.64	12,868	21,509	1.67
Saugus.....	13,480	46,399	3.44	12,737	25,986	2.04
Winchester.....	12,000	27,030	2.25	11,513	43,336	3.76
Reading.....	9,190	8,597	0.94	8,691	14,938	1.72
Stoneham.....	9,090	17,396	1.91	8,981	37,661	4.20
Lexington.....	8,400	23,244	2.77	7,818	30,391	3.89
Total of Group 3.....	119,020	\$571,414	\$4.81	112,421	\$478,737	\$4.26

¹ As defined for census purposes.

CITY OR TOWN	1927			FIVE-YEAR AVERAGE, 1923-1927		
	Population	Losses	Per Capita Loss	Average Population	Average Losses	Per Capita Loss
GROUP 4						
Weymouth.....	18,100	\$65,487	\$3.62	17,263	\$43,428	\$2.51
Wakefield.....	16,650	—	—	15,602	¹ 26,837	1.72
Dedham.....	15,160	22,136	1.46	13,908	28,697	2.04
Braintree.....	14,230	60,594	4.26	13,187	63,372	4.80
Wellesley.....	10,200	97,571	9.56	9,060	51,305	5.65
Needham.....	9,760	20,029	2.05	8,971	53,390	5.95
Swampscott.....	9,300	8,770	0.94	8,995	12,937	1.44
Hingham.....	6,380	107,075	16.70	6,156	² 37,869	6.15
Canton.....	5,900	4,250	0.72	5,899	18,137	3.08
Weston.....	3,150	24,347	7.73	2,895	68,282	23.59
Cohasset.....	3,000	—	—	2,891	² 12,176	4.21
Hull.....	2,720	—	—	2,649	—	—
Westwood.....	1,850	2,000	1.08	1,709	9,363	5.47
Nahant.....	1,750	6,329	3.61	1,626	42,840	26.35
Dover.....	1,112	—	—	1,041	¹ 9,465	9.09
Total of Group 4.....	95,780	\$418,588	\$4.38	111,852	\$478,098	\$4.28

¹ Average of 4 years² Average of 3 years

Blank spaces indicate no loss figure reported.

FIRE LOSSES IN GREATER BOSTON — RECAPITULATION

	1927			FIVE-YEAR AVERAGE, 1923-1927		
	Population	Losses	Per Capita Loss	Population	Losses	Per Capita Loss
1. Boston Proper.....	799,000	\$3,694,642	\$4.62	784,200	\$5,064,714	\$6.46
2. Cities and Towns over 20,000 Population in Greater Boston.....	849,000	2,977,484	3.50	810,480	3,061,780	3.78
Total.....	1,648,000	\$6,672,126	\$4.05	1,594,680	\$8,126,494	\$5.10
3. Cities and towns in Greater Boston included in Metro- politan Fire Prevention Dis- trict.....	119,020	\$571,414	\$4.81	112,421	\$478,737	\$4.26
4. Cities and Towns in Greater Boston Census Area not in- cluded in Metropolitan Fire Prevention District.....	95,780	418,588	4.38	111,852	478,098	4.28
Total.....	1,862,800	\$7,662,128	\$4.11	1,818,953	\$9,083,329	\$4.99

PER CAPITA FIRE LOSSES IN GREATER BOSTON, 1918-1927—RECAPITULATION

YEARS	Greater Boston	1 Boston	2 Cities Over 20,000	1 and 2	Group 3	Group 4
1918.....	\$3.07	\$3.55	\$2.75	\$3.17	\$1.43	\$3.14
1919.....	2.54	3.19	2.12	2.58	2.34	1.88
1920.....	4.52	3.99	5.35	4.66	4.38	2.48
1921.....	4.14	5.35	2.84	4.08	1.85	7.13
1922.....	3.62	4.33	3.12	3.72	2.32	3.39
1923.....	5.63	8.15	3.41	5.78	5.97	2.95
1924.....	5.17	6.09	4.84	5.45	2.75	3.40
1925.....	5.14	6.91	3.40	5.13	3.69	6.90
1926.....	5.01	6.55	3.76	5.10	4.11	4.49
1927.....	4.11	4.62	3.50	4.05	4.81	4.38

APPENDIX 11 A

MASSACHUSETTS ARSON LAWS

GENERAL LAWS, CHAPTER 266, CRIMES AGAINST PROPERTY

SECTION 1. Whoever wilfully and maliciously burns the dwelling house of another or a building adjoining such dwelling house, or wilfully and maliciously sets fire to a building by the burning whereof such dwelling house is burned, shall be punished by imprisonment in the state prison for life or for any term of years.

SECTION 2. Whoever wilfully and maliciously burns in the night time a meeting house, church, court house, town house, college, academy, jail or other building, which has been erected for public use, or a banking house, ware house, store, manufactory or mill of another being with the property therein of the value of one thousand dollars, or a barn, stable, shop or office of another within the curtilage of a dwelling house, or any other building by the burning whereof any building mentioned in this section is burned in the night time, shall be punished by imprisonment in the state prison for life or for any term of years.

SECTION 3. Whoever wilfully and maliciously burns in the day time a building, the burning of which in the night time might be punished under the preceding section, shall be punished by imprisonment in the state prison for not more than ten years.

SECTION 4. Whoever wilfully and maliciously burns a banking house, warehouse, store, manufactory, mill, barn, stable, shop, office, outhouse or other building of another, which is not described in section two, or a bridge, lock, dam, flume, ship or vessel of another, shall be punished by imprisonment in the state prison for not more than ten years.

SECTION 5. Whoever wilfully and maliciously burns or otherwise destroys or injures a pile or parcel of wood, boards, timber or other lumber, or any fence, bars or gate, or a stack of grain, hay or other vegetable product, or any vegetable product severed from the soil and not stacked, or any standing tree, grain, grass or other standing product of the soil, or the soil itself, of another, shall be punished by imprisonment in the state prison for not more than five years or by a fine of not more than five hundred dollars and imprisonment in jail for not more than one year.

SECTION 6. The preceding sections shall apply to a married woman who commits any of the crimes therein described, although the property burned or set fire to belongs partly or wholly to her husband.

SECTION 7. Whoever by wantonly or recklessly setting fire to any material, or by increasing a fire already set, causes injury to, or the destruction of, any growing or standing wood of another shall be punished

by a fine of not more than one hundred dollars or by imprisonment for not more than six months.

SECTION 8. Whoever wilfully or without reasonable care sets or increases a fire upon land of another whereby the property of another is injured, or whoever negligently or wilfully suffers any fire upon his own land to extend beyond the limits thereof, whereby the woods or property of another are injured, shall be punished by a fine of not more than two hundred and fifty dollars.

SECTION 9. Whoever, in a town which accepts this section or has accepted corresponding provisions of earlier laws, sets a fire on land which is not owned or controlled by him and before leaving the same neglects to entirely extinguish such fire, or whoever wilfully or negligently sets a fire on land which is not owned or controlled by him whereby property is endangered or injured, or whoever wilfully or negligently suffers a fire upon his own land to escape beyond the limits thereof to the injury of another, shall be punished by a fine of not more than one hundred dollars or by imprisonment in jail for not more than one month, or both, and shall also be liable for all damages caused thereby. Such fine shall be equally divided between the complainant and the town. This section shall not apply to cities.

SECTION 10. Whoever, with intent to injure the insurer, burns a building or any goods, wares, merchandise or other chattels belonging to himself or another, and which are at the time insured against loss or damage by fire, shall be punished by imprisonment in the state prison for not more than twenty years.

SECTION 11. Whoever, within twenty-four hours prior to the burning of a building or other property, wilfully, intentionally and without right cuts or removes a bell rope or a wire or conduit connected with a fire alarm signal system or injures or disables any fire alarm signal box or any part of such system in the vicinity of such building or property, or cuts, injures or destroys an engine, hose or other fire apparatus in said vicinity shall be punished by a fine of not more than five hundred dollars or by imprisonment for not more than two years.

SECTION 12. Whoever, during the burning of a building or other property, wilfully and maliciously cuts or removes a bell rope or a wire or conduit connected with a fire alarm signal system or injures or disables any fire alarm signal box or any part of such system in the vicinity of such building or property, or otherwise prevents an alarm being given, or whoever cuts, injures or destroys an engine, hose or other fire

apparatus, in said vicinity, or otherwise wilfully and maliciously prevents or obstructs the extinction of a fire shall be punished by imprisonment in the state prison for not more than seven years or in jail for not more than two and one half years or by a fine of not more than one thousand dollars.

SECTION 13. Whoever wantonly or maliciously injures a fire engine or other fire apparatus shall be punished by a fine of not more than five hundred dollars or by imprisonment for not more than two years, and shall be further ordered to recognize with sufficient surety or sureties for his good behaviour during such term as the court shall order.

SECTION 23. Whoever steals, conveys away or conceals any furniture, goods, chattels, merchandise or effects of persons whose houses or buildings are on fire or are endangered thereby, and does not, within two days thereafter, restore the same or give notice of his possession thereof to the owner, if known, or, if unknown, to the mayor or one of the aldermen, selectmen or firewards, of the place, shall be guilty of larceny.

SECTION 24. Whoever steals in a building which is on fire, or steals property which has been removed in consequence of an alarm caused by fire, shall be punished by imprisonment in the state prison for not more than five years or by a fine of not more than five hundred dollars and imprisonment in jail for not more than two years.

SECTION 134. Whoever, between April first and October first, sets fire to a coal pit or pile of wood, for the purpose of charring the same, on any woodland in the cities of New Bedford or Fall River or in the towns of Dartmouth, Freetown, Fairhaven, Middleborough or Rochester, shall forfeit one hundred dollars. Whoever, between the times aforesaid, sets fire to any brush wood or bushes on any part of such woodland, or on land adjoining thereto, so as to cause the burning of such brush wood or bushes, shall forfeit fifty dollars. All forfeitures under this section shall be equally divided between the city or town in which the offence is committed and the person who sues therefor.

APPENDIX 11 B

MODEL ARSON LAW

(As Recommended by Fire Marshal's Section National Fire Protection Association)

CRIMES TO PROPERTY

Arson; Punishment

SECTION 1. Any person who wilfully and maliciously sets fire to or burns or causes to be burned or who aids, counsels or procures the burning of any dwelling house, or any kitchen, shop, barn, stable or other outhouse that is parcel thereof, or belonging to or adjoining thereto, whether the property of himself or of another, shall be guilty of Arson, and upon conviction thereof, be sentenced to the penitentiary for not less than two nor more than twenty years.

Burning Buildings, Etc., Other Than Dwellings

SECTION 2. Any person who wilfully and maliciously sets fire to or burns or causes to be burned or who aids, counsels or procures the burning of any barn, stable, garage or other building, whether the property of himself or of another, not a parcel of a dwelling house; or any shop, storehouse, warehouse, factory, mill or other building, whether the property of himself or of another; or any church, meeting house, court house, work house, school, jail or other public building or any public bridge; shall, upon conviction thereof, be sentenced to the penitentiary for not less than one or more than ten years.

Of Other Property

SECTION 3. Any person who wilfully and maliciously sets fire to or burns or causes to be burned or who aids, counsels or procures the burning of any barrack, cock, crib, rick or stack of hay, corn, wheat, oats, barley or other grain or vegetable product of any kind; or any field of standing hay or grain of any kind; or any pile of coal, wood or other fuel; or any pile of planks, boards, posts, rails or other lumber; or any street car, railway car, ship, boat or other water craft, automobile or other motor vehicle; or any other personal property not herein specifically named; (such

property being of the value of twenty-five dollars and the property of another person) shall, upon conviction thereof, be sentenced to the penitentiary for not less than one nor more than three years.

Burning to Defraud Insurer

SECTION 4. Any person who wilfully and with intent to injure or defraud the insurer sets fire to or burns or causes to be burned or who aids, counsels or procures the burning of any goods, wares, merchandise or other chattels or personal property of any kind, whether the property of himself or of another, which shall at the time be insured by any person or corporation against loss or damage by fire; shall, upon conviction thereof, be sentenced to the penitentiary for not less than one nor more than five years.

Attempt to Burn Buildings or Property

SECTION 5. Any person who wilfully and maliciously attempts to set fire to or attempts to burn or to aid, counsel or procure the burning of any of the buildings or property mentioned in the foregoing sections, or who commits any act preliminary thereto, or in furtherance thereof, shall upon conviction thereof, be sentenced to the penitentiary for not less than one nor more than two years or fined not to exceed one thousand dollars. The placing or distributing of any flammable, explosive or combustible material or substance, or any device in any building or property mentioned in the foregoing sections in an arrangement or preparation with intent to eventually wilfully and maliciously set fire to or burn same, or to procure the setting fire to or burning of same shall, for the purposes of this act constitute an attempt to burn such building or property.

APPENDIX 13 A

AUTHORITY FOR VARIOUS REGULATIONS ON FIRE PREVENTION AND FIRE PROTECTION

General Laws, Chapter 30.

SECTION 37. Every department, commission, board or official vested by law with the power to make and issue rules or regulations general in scope, and to be observed or performed under penalty for the violation thereof, shall file attested copies thereof, together with a citation of the law by authority of which the same purport to have been issued, with the state secretary, and such rules or regulations, whether or not they require the approval of the governor and council, or other authority, before taking effect, shall not take effect until so filed. The foregoing provision shall not apply to rules or regulations issued by commissions, boards or officials of towns, or to municipal ordinances or by-laws, or to rules or regulations affecting solely the internal management or discipline of a department, commission, board or office, nor to orders or decrees made in specific cases within the jurisdiction of a department, commission, board or official. The state secretary shall file and index all rules and regulations filed with him hereunder, noting and keeping available such references to preceding rules and regulations as may be necessary for certification purposes.

General Laws, Chapter 48 — Fires.

SECTION 53. They (Board of Fire Engineers of local fire department) may make regulations as to the carrying of fire, firebrands, lighted matches or other ignited materials openly in the streets or thoroughfares of their town, or of such parts thereof as they may designate, or as to prohibiting owners or occupants of buildings within their town, or such part thereof as they may designate, from maintaining any defective chimney, hearth, oven, stove or stove pipe, fire frame or other fixture, deposit of ashes or whatever may give just cause of alarm or be the means of kindling or spreading fire. Whoever violates any such rule or regulation shall forfeit not more than twenty dollars.

Apparently no regulations have been issued hereunder.

SECTION 87 (as inserted by chapter 343 of the Acts of 1924). The Department of Public Safety may make rules and regulations providing for the standardization throughout the commonwealth of threads on fire hose couplings, fittings and hydrant outlets for public fire protection. The state fire marshal shall prepare said rules and regulations and submit them to the commissioner of public safety, and they shall take effect subject to sec-

tion thirty-seven of chapter thirty when approved by said commissioner and by the governor and council and on such dates as they may fix.

Regulations issued hereunder: "Standardization of Threads on Fire Hose Couplings, Fittings and Hydrants for Public Fire Protection."

General Laws, Chapter 66, Public Records.

SECTION 1. The supervisor of public records, in this chapter called the supervisor of records shall take necessary measures to put the records of the commonwealth, counties, cities or towns in the custody and condition required by law and to secure their preservation. He shall see that the records of churches, parishes or religious societies are kept in the custody and condition contemplated by the various laws relating to churches, parishes or religious societies, and for these purposes he may expend from the amount appropriated for expenses such amount as he considers necessary; provided, that no measures shall be taken relative to the records of the commonwealth unless the same are approved by the supervisor of administration.

SECTION 11. Officers in charge of a state department, county commissioners, city councils and selectmen shall, at the expense of the commonwealth, county, city or town, respectively, provide and maintain fireproof rooms, safes or vaults for the safe keeping of the public records of their department, county, city or town, other than the records in the custody of teachers of the public schools, and shall furnish such rooms with fittings of non-combustible material only.

SECTION 12. All such records shall be kept in the rooms where they are ordinarily used, and so arranged that they may be conveniently examined and referred to. When not in use, they shall be kept in the fireproof rooms, vaults or safes provided for them.

Under these sections the supervisor of records issues a minimum specification for the construction of vaults. This specification is reasonably satisfactory except that nothing is said about vault doors. However, the supervisor of records must approve each installation so that vaults reasonably suitable for their purposes can be required hereunder.

General Laws, Chapter 123, Commitment and Care of Insane and other Mental Defectives.

SECTION 7. The department (State Department of Mental Diseases) shall provide for the efficient, economical and humane management of the state hospitals. It shall establish by-laws

and regulations, with suitable penalties, for the government of said state hospitals, shall determine the salaries of the officers and employees thereof, and shall provide for a monthly inspection and trial of fire apparatus belonging thereto, and for the proper organization and monthly drill of the officers and employees in use of the apparatus. It shall ascertain by actual examination and inquiry whether commitments to the state hospital are made according to law.

No uniform regulations have been issued under this section. It is reported, however, to be the custom of each institution to have some elementary regulations of its own.

General Laws, Chapter 143, Inspection of Buildings, Etc.

This chapter applies mainly to building construction. It is itself a code of building laws. Many detailed requirements are, however, left to the discretion of the inspectors enforcing it. The Department of Public Safety has issued "Regulations Relative to the Inspection of Buildings which are Subject to the Provisions of Chapter 143, General Laws," which regulations are apparently designed to take care of these discretionary matters. Part I of these regulations consists of definitions. Part II are general regulations. Part III is a building code applying to new buildings in cities and towns which have no building inspector or building department.

SECTION 72 (as amended by section 1 of chapter 478 of the Acts of 1923). No cinematograph or similar apparatus involving the use of a combustible film more than 10 inches in length, except one using only an enclosed incandescent lamp and cellulose acetate films not more than one and one quarter inches in width, shall, except as provided by sections eighty-five and eighty-six, be kept or used for the purpose of exhibiting such films in or upon the premises of a public building until such cinematograph or similar apparatus has been inspected and approved by an inspector, who shall have placed thereon a numbered metal tag; nor until a booth or enclosure, which has been inspected and approved by such an inspector and his certificate issued therefor, has been provided for said apparatus; nor until such precautions against fire as the commissioner of public safety may specify have been taken by the owner, user or exhibitor; provided, that no such apparatus shall be operated with oxyhydrogen gas, so-called, or with limelight. In addition, in Boston the location of any booth or enclosure surrounding such apparatus shall be approved by the building commissioner, who may order such additional precautions against fire as he may deem necessary.

SECTION 83. Sections seventy-two to seventy-six, inclusive, shall not apply to any motion picture machine operated with only cellulose acetate films not more than one inch and one fourth in width and requiring not more than five hundred watts of electric current to operate the arc; provided, that such machines shall not be kept or used in a public building except under such regulations as the commissioner of public safety shall prescribe.

Regulations issued hereunder: "Cinematographs for Exhibition of Motion Pictures." (1923.)

General Laws, Chapter 146, Inspection of Boilers, Etc. (Board of Boiler Rules provided for by General Laws, chapter 22, section 10.)

SECTION 2. The board shall formulate rules for the construction, installation and inspection of steam boilers, and for ascertaining the safe working pressure to be carried therein; prescribe tests, if it deems it necessary, to ascertain the qualities of materials used in the construction of boilers; formulate rules regulating the construction and sizes of safety valves for boilers of different sizes and pressures, the construction, use and location of fusible safety plugs, appliances for indicating the pressure of steam and the level of water in the boiler, and such other appliances as the board may deem necessary to safety in operating steam boilers; and make a standard form of certificate of inspection. The attorney general shall assist the board in framing the rules. Such rules shall be submitted to the governor and council for their approval, and when approved shall have the force of law, and shall be printed and furnished by the commissioner to those requesting them.

Regulations issued hereunder: "Steam Boiler Rules."

SECTION 34. No person shall install or use, or cause to be installed or used, any tank or other receptacles, except when attached to locomotives, street or railway cars, vessels or motor vehicles, for the storing of compressed air at any pressure exceeding fifty pounds per square inch, for use in operating pneumatic machinery, unless the owner or user thereof shall hold a certificate of inspection issued by the division, certifying that the said tank or other receptacle has duly been inspected within two years, or unless the owner or user shall hold a policy of insurance upon the said tank or other receptacle issued by an insurance company authorized to insure air tanks within the commonwealth, together with a certificate of inspection from an insurance inspector who holds a certificate of competency described in section sixty-two.

SECTION 35. The board shall prescribe regulations for the size, shape, construction, gauges,

operation, maximum pressure, safety devices, use of oil, and other appurtenances necessary for the safe operation of such tanks or other receptacles.

Regulations issued hereunder: "Air Tank Regulations." (1918.)

SECTION 43. The board shall formulate rules for the size, design, location and piping of safety valves on ammonia compressors.

Regulations issued hereunder: "Ammonia Compressor Safety Valve Rules." (1915.)

Board of Elevator Regulations provided for by General Laws, chapter 22, section 11.)

SECTION 68. The board of elevator regulations shall frame amendments to the regulations relating to the construction, installation, alteration and operation of all elevators, and relative to the location, design and construction of shafts or enclosures for elevators, safety devices, gates and other safeguards, protection against the elevator or hoisting machinery, and means to prevent the spread of fire, and also amendments to the regulations designed to make uniform the work of the inspectors of the division of inspection of the department and of inspectors of buildings throughout the commonwealth.

SECTION 69. The board of elevator regulations shall, within three months after its members are appointed, draft amendments to the regulations and submit the same to the governor and council for their approval. Within sixty days after such submission they shall approve the same, with such alterations and amendments and after such public hearings as they may deem proper; and the regulations so altered and amended shall become part of the rules and regulations pertaining to elevators. The commissioner of public safety shall furnish upon application a printed copy of the regulations to all manufacturers of elevators operating in the commonwealth, to all inspectors of buildings in the cities and towns of the commonwealth, and to all others who are concerned. The board shall be dissolved upon the approval of the regulations by the governor and council.

Regulations issued hereunder: "Elevator and Escalator Regulations."

General Laws, Chapter 148, Fire Prevention.

SECTION 10 (as amended by chapter 273 of the Acts of 1921 as amended by section 2 of chapter 485 of the Acts of 1921). The department may make rules and regulations for the keeping, storage, use, manufacture, sale, handling, transportation or other disposition of gunpowder, dynamite, crude petroleum or any of its products, or explosive or inflammable fluids or compounds,

tablets, torpedoes or any explosives of a like nature, or any other explosives, fireworks, firecrackers, or any substance having such properties that it may spontaneously, or acting under the influence of any contagious substance, or of any chemical or physical agency, ignite, or inflame or generate inflammable or explosive vapors or gasses to a dangerous extent, and may prescribe the materials and construction of buildings to be used for any of the said purposes, except that cities and towns may by ordinances or by-laws prohibit the sale or use of fireworks or firecrackers within the city or town, or may limit the time within which firecrackers and torpedoes may be used.

SECTION 11. The marshal shall submit to the commissioner rules and regulations to carry out the provisions of sections ten and thirty-nine, which shall take effect subject to section thirty-seven of chapter thirty when approved by the commissioner and by the governor and council, and on such dates as they may fix.

(The following section does not apply to the Metropolitan Fire Prevention District.)

SECTION 14 (as amended by section 3 of chapter 485 of the Acts of 1921, by chapter 254 of the Acts of 1924, by section 1 of chapter 335 of the Acts of 1925, by section 1 of chapter 260 of the Acts of 1928 and by section 1 of chapter 325 of the Acts of 1928). No building or other structure shall, except as provided in section fifteen, be used for the keeping, storage, manufacture or sale of any of the articles named in section ten, except fireworks, firecrackers and torpedoes, unless the aldermen or selectmen shall have granted a license therefor after a public hearing, held in the case of cities by the aldermen or any committee thereof designated by them, notice of the time and place of which hearing shall have been given, at the expense of the applicant, by the clerk of the city or the commission having the authority to grant such licenses or by the selectmen, by publication, not less than seven days prior thereto, in a newspaper published in the representative district, if any, otherwise in the city or town, wherein the land on which such license is to be exercised is situated, and also by the applicant by registered mail, not less than seven days prior to such hearing, to all owners of real estate abutting on said land, and unless a permit shall have been granted therefor by the marshal or by some official designated by him for the purpose, provided, that any building or other structure once used under a license and permit granted as aforesaid, or any building or other structure lawfully used for any of said purposes, may be continued in such use from year to year if the owner or occupant thereof shall

annually, on or before April thirtieth, while such use continues, file for registration with the clerk of the city or town where such building or other structure is situated, a certificate reciting such use and occupancy; and provided, further, that any building used as a garage for storing not more than two vehicles, when once used under such a license and permit, or lawfully used for such purpose, may be continued in use from year to year without such annual registration, and continuous use and occupancy thereof for such purpose shall be presumed. The department may by regulation prescribe the amount of explosives, crude petroleum or any of its products, or of any other inflammable fluid or compound, that may be kept for private use in a building or other structure without a license, permit or registration, or any of them. Every license and permit issued hereunder shall expire on April thirtieth following the date of issue, and registrations hereunder shall be effected on or before April thirtieth to take effect on May first following. Such fee as may be established from time to time by ordinance or by-law may be charged for any such license, permit and registration, respectively; provided, that the fee for such registration shall be one-half of the amount of the fee for such a license.

The right to use a building or other structure for any of said purposes may be revoked for cause, after notice and a hearing given to such owner or occupant, by the aldermen or selectmen having authority to grant licenses for such use, or by the marshal. Such building or structure shall always be subject to such alterations in construction and to such regulations of its use in respect to protection against fire or explosion as the department may prescribe.

(The following sections apply only in the Metropolitan Fire Prevention District.)

SECTION 30 (as amended by chapter 274 of the Acts of 1928). The marshal shall have within the metropolitan district the powers given by sections ten, thirteen, fourteen, twenty, twenty-one and twenty-two to license persons or premises, or to grant permits for, or to inspect or regulate, the keeping, storage, use, manufacture, sale, handling, transportation or other disposition of gunpowder, dynamite, nitroglycerine, camphine or any similar fluids or compounds, crude petroleum or any of its products, or any explosive or inflammable fluids or compounds, tablets, torpedoes, rockets, toy pistols, fireworks, fire crackers, or any other explosives, and the use of engines and furnaces as described in section one hundred and fifteen of chapter one hundred forty; provided, that the city council of a city or the selectmen of a town may disapprove the granting of such a license

or permit, and upon such disapproval or upon the refusal to grant or issue the same by the officer or board designated for the purpose by the marshal under the following section, the license or permit shall in no event be granted or issued. In Boston certificates of renewal of licenses as provided in section fourteen shall be filed annually for registration with the fire commissioner, accompanied by a fee of one dollar.

SECTION 40 (as amended by section 6 of chapter 325 of the Acts of 1928). The marshal may provide that any rule shall apply generally throughout the metropolitan district or to any specified part thereof or to any class or description of premises, which shall take effect when approved by the commissioner and the governor and council, and on such dates as they may fix.

Regulations issued hereunder:

"Discharge of Oil on Waters." (1921.)

"Inflammable Compounds." (1914.)

"Paints, Oils and Inflammable Fluids." (1917.)

(Applies in Metropolitan Fire Prevention District only.)

"Light Fuel Oil Heating Apparatus." (1923.)

"Garages inside Metropolitan District." (1923.)

"Garages outside Metropolitan District." (1923.)

"Dry Cleaning and Dry Dyeing Establishments." (1914.)

"Explosives." (1924.)

"Fireworks." (1921.)

"Celluloid Regulations." (1929.)

"Inflammable Motion Picture Film." (1916.)

Section 39 also lists various items which, in the Metropolitan Fire Prevention District may be covered by regulations or special orders. As far as can be determined, however, no regulations have been issued thereunder.

SECTION 54 (as amended by chapter 104 of the Acts of 1921). No person shall construct, maintain or use any tank or container of more than ten thousand gallons capacity, unless constructed principally of wood, for the storage of any fluid other than water, unless the same is underground, without first securing a permit therefor from the commissioner. Whoever violates this section or a rule or regulation made under the following section shall be punished by a fine of not less than fifty nor more than one thousand dollars.

SECTION 55. The department shall make rules and regulations governing the construction, use and maintenance of tanks to which the preceding section applies. Such rules and regulations shall not take effect until approved by the governor and council, and filed in the office of the state secretary.

Regulations issued hereunder: "Tanks and Containers." (1926.)

General Laws, Chapter 160.

SECTION 164. Every passenger, baggage, mail and express car, owned or regularly used on any railroad in the commonwealth, shall be provided with such safeguards against fire as the department (Public Utilities) in writing shall order. A corporation which violates this section shall forfeit three hundred dollars.

Under this section the State Department of Public Utilities requires all cars in passenger train service to be equipped with one or more fire extinguishers of a type satisfactory to the department. The effect of this excellent rule is largely nullified by the sort of appliances accepted as "extinguishers," which are commonly not only practically worthless as fire extinguishers but engender a false sense of security.

SECTION 168. The department may make and revise regulations for testing boilers of locomotives used by railroad corporations, by other corporations, and by persons, firms or associations upon any railroad or railway within the commonwealth, and every person, firm, association and corporation other than a railroad corporation, so using a locomotive, shall inform the department in writing on or before June thirtieth of each year of the number of locomotives so used by him or it, together with the length of track or such railroad or railway, its location and uses, and such other information as the department may require. This section shall apply to railroads for private use authorized by section two hundred and forty-five of this chapter. Tests under regulations made as aforesaid shall, if possible, be made by the master mechanic of the corporation, association, person or firm which constructs, repairs or uses the boiler of the locomotive, and the report of such tests shall be in form satisfactory to the department. A corporation, association, firm or person using a locomotive in the commonwealth the boiler of which has not been tested in accordance with this section shall be punished by a fine of twenty dollars for every day after notice by the department during which such use continues.

Regulations issued hereunder: "Regulations for the Inspection and Test of Locomotive Boilers." Public Service Commission, 1914.

Boston Building Code. (Chapter 550, Acts of 1907, as amended, and other special Acts.)

In this code the Building Commissioner is given considerable discretionary power in certain matters. The following regulations are designed to cover certain discretionary matters.

"Regulations for the Better Safeguarding of Human Life and for Protection of Property against Fire." (1925.) Contains regulations on Automatic Sprinklers.

"Hospitals" (issued in connection with Health Department). (1926.)

"Requirements for Steel or Iron Stairs." (1927.)

"Skylights." (1924.)

"Standpipe Installation in Buildings Under Construction or Alteration." (1929.)

"Exit Signs." (1929.)

"Memorandum Requiring the Plastering on Wire Lath of Ceilings of Stores where Fires have Occurred." (1927.)

"List of Approved Foreign Cements." (1924.)

"List of Manufacturers of Approved Concrete Blocks."

In addition to the above are numerous general orders of the Building Commissioner, amplifying or interpreting certain provisions of the building code.

Electrical Code. (Various special acts and city ordinances cover electrical wiring placing it under the jurisdiction of the Fire Commissioner.) Chapter 268, Acts of 1898.

SECTION 2. The commissioner of wires (fire commissioner) shall be deemed the sole judge of what constitutes proper insulation and the safe installation of electric conductors and appliances within buildings, and is hereby authorized to make such rules and regulations as he may deem necessary to make such conductors and appliances as safe as possible.

Regulations issued hereunder: "Rules and Requirements of the Fire Commissioner for Electric Wiring and Apparatus." (Substantially the National Electrical Code.)

Chapter 307, Acts of 1917.

SECTION 1. Every commission, board or official vested by law with the power to make and issue rules and regulations general in scope, and to be observed or performed under penalty for the violation thereof, shall file attested copies thereof, together with a citation of the law by authority of which the same purport to have been issued, with the secretary of the commonwealth, and such rules and regulations shall not take effect until so filed. Nothing herein contained shall be deemed to apply to rules and regulations issued by commissions, boards or officials of cities or towns, or to municipal ordinances or by-laws, or to rules and regulations affecting solely the internal management or discipline of a commission or board, nor to orders or decrees made in specific cases within the jurisdiction of a commission, board or official.

SECTION 2. Every such order, rule or regulation now in effect shall, within six months after the passage of this act, be filed in accordance with the provisions of section one, and in default of such filing shall become null and void.

APPENDIX 13 B

COMMONWEALTH *v.* EDWARD E. BADGER (243 MASS. 137)

COMPLAINT, received and sworn to in the Municipal Court of the City of Boston on February 18, 1921, charging that, while Edward E. Badger was the owner of the building situated and numbered 81 Wareham Street, Boston, a part of that building, namely, the front rooms in the second and third floors, "were then and there being used in the business of manufacturing paper boxes, that the said building was then and there a building in which four or more persons were then and there usually employed therein above the second floor," that the fire marshal for the Metropolitan District on March 18, 1920, while the building was being so used, issued an "order in writing directed to the said Badger . . . ordering and directing him the said Badger, to equip the said building with automatic sprinklers," which was served on him on March 19, 1920, and that Badger within six months next ensuing after having received the order and notice of the marshal failed to comply with its requirement.

The notice given to the defendant by the state fire marshal was as follows:

"An inspection having been made by this Department on March 8, 1920, of the premises owned by you, to wit: Building No. 81 Wareham Street, Boston, Massachusetts, and known as the Badger Building, I find from the report of said inspection, which is now on file in this office, that said building is used in part for the business of working upon paper, to wit: paper boxes and the storage of paper, and that four or more persons are usually employed above the second floor.

"By virtue of the power conferred on me by chapter 795 of the Acts of 1914, or any act or acts in addition thereto, or amendment thereof, you are hereby ordered to equip the second and third floors of the front section of said building with automatic sprinklers in a manner satisfactory to the Building Commissioner of the City of Boston."

Superior Court, Massachusetts

On appeal to the Superior Court, the case was tried before Keating, J. Material evidence is described in the opinion. At the close of the evidence of the Commonwealth, the defendant rested and asked for a ruling that the evidence was insufficient to warrant a conviction. The motion was denied. The defendant then asked for the following rulings:

"1. That the notice and order of March 18, 1920, served upon the defendant, was not sufficiently definite and specific to impose any duty upon the defendant.

"2. A duty imposed upon the defendant by such order, to the satisfaction of the certain authorities, rendered the order so uncertain that the defendant was justified in ignoring it.

"3. That the burden is on the Commonwealth to prove that the work ordered could be performed for five per cent of the assessed value of the property, and that that burden has not been sustained.

"4. That the burden is on the Commonwealth to prove that the defendant was owner or occupant whose duty it was to install the automatic sprinkler, and that that burden has not been sustained.

"5. That the burden is on the Commonwealth to prove that four or more persons live or were usually employed on the premises above the second floor, and that that burden has not been sustained.

"6. That the burden is on the Commonwealth to show that the provisions of St. 1914, c. 795 were accepted by the city of Boston and that burden has not been sustained.

"7. That under the fundamental law of the land no man can be held criminally liable where his only offence is a failure to have work done which in the nature of the things he cannot do himself by his own labor and which he must employ others to do on his account."

The rulings were refused.

The defendant was found guilty; and alleged exceptions.

Text of Decision

Rugg, C. J. This is a complaint under G. L. c. 148, sec. 36, charging the defendant, as owner of a designated building in Boston, in which four or more persons were usually employed above the second story within rooms used in the manufacture of paper boxes, with having failed within six months after service of notice from the fire marshal to that effect to equip said building with automatic sprinklers.

The statute is not open to objection on constitutional grounds. It plainly is a regulation designed to protect persons working upon inflammable material in rooms higher than the second story from the peril of fire. It requires the installation of safety appliances in buildings where rooms in the third or higher stories are used for the manufacture of wooden, rattan or cane goods or other substances or stuffs likely to become easily ignited, fire in which would be peculiarly difficult to extinguish when once started, and in which flames might be expected to spread with dangerous rapidity. It is obviously enacted in the interests of public health and public safety. The statute relates only to the use of an existing building for specified dangerous occupations. It prohibits such use after seasonable notice unless the safety appliances are installed. Ample time after service of the notice is

allowed for change of the occupancy to a less hazardous business if that is preferred to installing the equipment required. It establishes no arbitrary or inflexible rule for the alteration of existing structures, lawful in every particular when erected. See *Commonwealth v. Alger*, 7 Cush. 53, 103. Compare Opinion of the Justices, 237 Mass. 598, and cases collected at pages 608 to 610. It is confined in its operation to providing safety appliances for buildings above a certain height used for occupations regarded by the general court as subjecting those engaged therein to peculiar risk from fire. Appropriate regulation of this kind comes within the principle of numerous decisions. *Commonwealth v. Roberts*, 155 Mass. 281. *Perry v. Bangs*, 161 Mass. 35. *Commonwealth v. Hubley*, 172 Mass. 58. *Commonwealth v. Maletsky*, 203 Mass. 241, 245. *Storer v. Downey*, 215 Mass. 273. *Baker v. Horan*, 227 Mass. 415, 421. *Stevens*, landowner, 228 Mass. 368. *Chase v. Proprietors of Revere House*, 232 Mass. 88. *Wheeler v. Boston*, 233 Mass. 275. *Commonwealth v. E. E. Wilson Co.* 241 Mass. 406. The statute here involved distinguishes the present case from *Durgin v. Minot*, 203 Mass. 26, *Goldstein v. Conner*, 212 Mass. 57, *Kilgour v. Gratto*, 224 Mass. 78, *Cawley v. Northern Waste Co.* 239 Mass. 540, and decisions of that character.

The complaint conforms to the terms and follows in substance the phraseology of G. L., c. 148, sec. 36, under which it is drawn. There is provision in sec. 41 of the same chapter that no rule or order shall be made or enforced which requires an expenditure by the owner or occupant of more than five per cent of the last annual assessed valuation of the land and buildings to which the rule or order refers. No averment as to the cost of repairs was made in the complaint and no proof as to the matter was offered by the Commonwealth. It was said by Chief Justice Gray in *Commonwealth v. Jennings*, 121 Mass. 47, at page 49, "It is a general rule of pleading, that when an exception or proviso is embodied in the clause which defines the offence, or, as it is commonly called, the enacting clause, it must be negatived in the indictment; but that if it is only found in a subsequent distinct clause of the same or another statute, it need not be so negatived." *Commonwealth v. Maxwell*, 2 Pick. 139. *Commonwealth v. Boyer*, 7 Allen, 306. *Commonwealth v. Shannihan*, 145 Mass. 99. That principle is applicable to the case at bar. The limitation as to the expense is not incorporated into the description of the substance of the offence but occurs in a subsequent section. Violation of its terms is matter of defence. No allegation or proof in this respect is required of the Commonwealth in the first instance.

The provisions of R. L., c. 148, secs. 28 to 50, are operative in the City of Boston without acceptance by the city council of Boston. This is plain from the definition of the Metropolitan District in sec. 28. See St. 1914, c. 795, secs. 1, 26, 28.

The notice from the state fire marshal served upon the defendant, after reciting the use of the building for manufacture of paper boxes and the storage of paper and the employment of four or more persons above the second floor, required the defendant to equip parts of the building "with automatic sprinklers in a manner satisfactory to the Building Commissioner of the City of Boston." This notice was not in conformity to the statute. The type of sprinkler and manner of installation are by the terms of the notice made wholly subject to the untrammelled discretion of the building commissioner of the City of Boston. The notice is objectionable in at least three respects: (1) The statute confers no authority upon the fire marshal to make any delegation of power or duty. *Commonwealth v. Staples*, 191 Mass. 384. *Brown v. Newburyport*, 209 Mass. 259, 266. *Cawley v. Northern Waste Co.* 239 Mass. 540, 543. See *Commonwealth v. Slocum*, 230 Mass. 180, 190. (2) Attempt to vest an untrammelled discretion in a public officer as to improvement of property without some rule for guidance has been often held void. *Newton v. Belger*, 143 Mass. 598. *Commonwealth v. Maletsky*, 203 Mass. 241. (3) The notice was vague and indefinite in requiring the installation of a mechanical device to conform to the satisfaction of a city officer without affording by reference or otherwise any guide. It is fair to afford to the landowner or occupant required to make expensive improvements some guide, rule or information as to what he must do and the manner in which it is to be done, in order that he may have a basis for knowing how to comply with the requirement and when he has satisfied the law. *General Baking Co. v. Street Commissioners*, 242 Mass. 194.

It is not necessary to determine what if any jurisdiction the building commissioner of the City of Boston possesses in the premises. See St. 1907, c. 550, secs. 1, 2, 9, 13, 104, 111; *Commonwealth v. Hayden*, 211 Mass. 296. It was not possible for the fire marshal by his notice to enlarge or curtail that jurisdiction in any respect. No provision of St. 1907, c. 550, has been called to our attention and we have discovered none which purports to confer upon the building commissioner of the City of Boston the unlimited power implied in the notice of the fire marshal. *Williamson v. United States*, 207 U. S. 425, 462.

The construction put upon somewhat similar words in *Sawyer v. State Board of Health*, 125 Mass. 182, 187, manifestly is to be confined to the peculiar facts there disclosed and cannot reasonably be extended to a case like the present. It follows that a verdict of not guilty ought to have been directed. The ground upon which this decision rests renders it unnecessary to consider the other points urged by the defendant.

APPENDIX 14

GENERAL LAWS, CHAPTER 148, FIRE PREVENTION

(As codified 1920, and including subsequent amendments through 1928)

DEFINITIONS

SECTION 1. In this chapter the following words, unless a different meaning is required by the context or is specifically prescribed, shall have the following meanings:

"Commissioner," the commissioner of public safety.

"Department," the department of public safety.

"Division," the division of fire prevention of the department of public safety.

"Inspector," an inspector of the division of fire prevention of the department of public safety.

"Marshal," the state fire marshal.

"Metropolitan district," the metropolitan fire prevention district described in section twenty-eight.

APPLICATION OF CERTAIN SECTIONS¹

SECTION 2 (as amended by section 1 of chapter 485 of the Acts of 1921 and by section 1 of chapter 277 of the Acts of 1928). Except as otherwise provided in section thirty, sections six, seven-a, ten, thirteen, fourteen, nineteen, twenty and twenty-two shall not apply to the Metropolitan district. Sections twenty-eight to fifty-one, inclusive, shall apply only to said district.

SECTION 3. The marshal in Boston, the board of fire engineers in cities and in towns in which such a board is established, whether the organized fire district includes within its limits the whole territory of the town or not, and the selectmen in towns in which no fire district is organized and no board of fire engineers is established, shall investigate the cause and circumstances of every fire in such city or town by which property has been destroyed or damaged, especially to ascertain whether it was caused by carelessness or design. They shall begin such investigations within two days, excluding Sunday, after such fire, and the marshal may, in his discretion, supervise and direct the same. The board making investigations of fires may notify the said marshal, and shall within one week after the fire file with him a written statement of all the facts relative to the cause and origin of the fire, the kind, value and ownership of the property destroyed, and such information as he may require. He shall keep in his office a record of all fires occurring in the commonwealth, with the results of said investigation. Such record shall be open to public inspection, and copies of such portions as the commissioner of insurance requires shall be forwarded to him before January fifteenth.

SECTION 4. The marshal shall investigate or cause

to be investigated the cause and circumstances of all fires of which he has notice, as provided in the preceding section, by which property has been damaged or destroyed, especially to ascertain whether the fire was caused by carelessness or design. For these purposes the marshal or some person designated by the commissioner may summon and examine on oath any person supposed to know or have the means of knowing any material facts touching the subject of investigation. Such witnesses may be kept apart and examined separately, and such examination shall be reduced to writing, and false swearing therein shall be deemed perjury and be punishable as such. Any justice of the municipal court of the City of Boston or of the superior court, upon application of the marshal or some person designated by the commissioner, may compel the attendance of such witnesses and the giving of such testimony before him in the same manner and to the same extent as before said court. If upon such investigation he believes that the evidence is sufficient to charge any person with crime in causing the fire, he shall make a complaint therefor, and shall furnish the proper officers with the evidence and names of witnesses obtained by him. He shall, when required, report to the commissioner of insurance his proceedings and the progress in prosecutions for causing fires and the results thereof.

SECTION 5. Any inspector may, in the performance of the duties imposed by this chapter, at reasonable hours enter upon and examine any building or premises where any fire has occurred, or other buildings or premises adjoining or near the same, with the consent of the occupant thereof.

SECTION 6 (as amended by section 2 of chapter 277 of the Acts of 1928). The marshal, the chiefs of fire departments in cities, and the chief engineer, or the chairman of the board of selectmen in towns having no engineer, or any person designated by any of them, may, and upon complaint of a person having an interest in any building or premises or property adjacent thereto, shall, at all reasonable hours, enter into buildings and upon premises, which term for the purposes of the remainder of this section shall include alleys adjacent thereto, within their jurisdiction and make an investigation as to the existence of conditions likely to cause fire or to prevent or retard easy ingress into or egress from any such building or premises by the occupants or by firemen. They shall, in writing, order such conditions, if existing, to be remedied, and whenever such officers or persons find in any building or upon any premises any accumulation of combustible

¹ Chapter 205, Acts of 1929, strikes out the words "six, seven-a" in section 2, making sections 6 and 7-a apply to the entire state.

rubbish, including waste paper, rags, cardboard, string, packing material, sawdust, shavings, sticks, waste leather or rubber, broken boxes or barrels or other refuse that is or may become dangerous as a fire menace or as an obstacle to such easy ingress into or egress from such buildings or premises, they shall, in writing order the same to be removed or such conditions to be remedied; provided, that no such order shall be inconsistent with any building law, ordinance or by-law applicable to such buildings or premises or with any permit lawfully issued thereunder. Notice of such order shall be served upon the owner, occupant or his authorized agent, by any person authorized to serve civil or criminal process, in the manner prescribed by section one hundred and twenty-four of chapter one hundred eleven. If said order is not complied with within twenty-four hours after the return of service, the person making such order, or any person designated by him, may enter into such building or upon such premises and remove such rubbish or abate such condition at the expense of such owner or occupant. Any expense so incurred shall be a lien upon such building or premises and shall be enforced within the time and in the manner provided for the collection of taxes upon real estate. Failure or refusal by said owner or occupant to comply with said order shall be punished by a fine of not less than ten or more than fifty dollars for each consecutive forty-eight hours during which such failure or refusal to comply continues.

SECTION 7 (as amended by section 3 of chapter 277 of the Acts of 1928). Any city or town officer named in section three who neglects or refuses to comply with any requirement of the preceding sections shall be punished by a fine of not less than twenty-five nor more than two hundred dollars.

SECTION 7a. The marshal, the chiefs of fire departments in cities, and the chief engineer in towns or the chairman of the board of selectmen in any town having no engineer, may by order, which shall not apply to one family dwellings, (1) Require the use of metal receptacles for ashes, waste paper and rubbish; (2) Require the use of self-closing safety cans for volatile or inflammable fluids or compounds; (3) Require oily rags and waste, when not in actual use, to be stored in metal containers with self-closing covers and riveted joints, the container to be raised at least four inches above the floor on metal legs; and (4) Prohibit the use of rubber tubing as connections for lamps, stoves and irons using inflammable gas for fuel, except such flexible rubber covered metal tubing as may be approved by the commissioner. Any violation of any order under this section shall be punished by a fine of not less than ten nor more than fifty dollars for each consecutive forty-eight hours during which such violation continues.

SECTION 8. The marshal shall submit annually, before February fifteenth, a detailed report of all official

action in relation to fires to the commissioner of insurance, who shall embody the material portions thereof in his annual report.

SECTION 9. The marshal may report to insurance companies, to owners of property, or to other persons interested in the subject matter of an investigation of the cause and circumstances of a fire any information obtained by such investigation which may in his opinion require attention from or by such insurance companies, owners of property or other persons.

SECTION 10 (as amended by chapter 273 of the Acts of 1921, as amended by section 2 of chapter 485 of the Acts of 1921). The department may make rules and regulations for the keeping, storage, use, manufacture, sale, handling, transportation or other disposition of gunpowder, dynamite, crude petroleum or any of its products, or explosive or inflammable fluids or compounds, tablets, torpedoes or any explosives of a like nature, or any other explosives, fireworks, firecrackers, or any substance having such properties that it may spontaneously, or acting under the influence of any contiguous substance, or of any chemical or physical agency, ignite, or inflame or generate inflammable or explosive vapors or gases to a dangerous extent, and may prescribe the materials and construction of buildings to be used for any of the said purposes, except that cities and towns may by ordinances or by-laws prohibit the sale or use of fireworks or firecrackers within the city or town, or may limit the time within which firecrackers and torpedoes may be used.

SECTION 11. The marshal shall submit to the commissioner rules and regulations to carry out the provisions of sections ten and thirty-nine, which shall take effect subject to section thirty-seven of chapter thirty when approved by the commissioner and by the governor and council, and on such dates as they may fix.

SECTION 12 (as amended by chapter 255 of the Acts of 1921 as amended by chapter 398 of the Acts of 1925). The commissioner may expend the amount annually appropriated for maintaining a laboratory to aid in the enforcement of the laws relative to explosives and inflammable fluids and compounds, and for the employment of expert assistance to aid in the enforcement of such laws and to perform such duties as the commissioner may prescribe. Expert assistants employed under this section shall be exempt from the requirements of civil service law and the rules and regulations made thereunder.

SECTION 13. No building shall be used for the manufacture of fireworks or firecrackers without a license from the aldermen or selectmen and a permit from the marshal.

SECTION 14 (as amended by section 3 of chapter 485 of the Acts of 1921, by chapter 254 of the Acts of 1924, by section 1 of chapter 335 of the Acts of 1925, by

section 1 of chapter 260 of the Acts of 1928 and by section 1 of chapter 325 of the Acts of 1928). No building or other structure shall, except as provided in section fifteen, be used for the keeping, storage, manufacture or sale of any of the articles named in section ten, except fireworks, firecrackers and torpedoes, unless the aldermen or selectmen shall have granted a license therefor after a public hearing, held in the case of cities by the aldermen or any committee thereof designated by them, notice of the time and place of which hearing shall have been given, at the expense of the applicant, by the clerk of the city or the commission having the authority to grant such licenses or by the selectmen, by publication, not less than seven days prior thereto, in a newspaper published in the representative district, if any, otherwise in the city or town, wherein the land on which such license is to be exercised is situated, and also by the applicant by registered mail, not less than seven days prior to such hearing, to all owners of real estate abutting on said land, and unless a permit shall have been granted therefor by the marshal or by some official designated by him for the purpose, provided, that any building or other structure once used under a license and permit granted as aforesaid, or any building or other structure lawfully used for any of said purposes, may be continued in such use from year to year if the owner or occupant thereof shall annually, on or before April thirtieth, while such use continues, file for registration with the clerk of the city or town where such building or other structure is situated, a certificate reciting such use and occupancy; and provided, further, that any building used as a garage for storing not more than two vehicles, when once used under such a license and permit, or lawfully used for such purposes, may be continued in use from year to year without such annual registration, and continuous use and occupancy thereof for such purpose shall be presumed. The department may by regulation prescribe the amount of explosives, crude petroleum or any of its products, or of any other inflammable fluid or compound that may be kept for private use in a building or other structure without a license, permit or registration, or any of them. Every license and permit issued hereunder shall expire on April thirtieth following the date of issue, and registrations hereunder shall be effected on or before April thirtieth to take effect on May first following. Such fee as may be established from time to time by ordinance or by-law may be charged for any such license, permit and registration, respectively; provided, that the fee for such registration shall be one-half of the amount of the fee for such a license.

The right to use a building or other structure for any of said purposes may be revoked for cause, after notice and a hearing given to such owner or occupant, by the aldermen or selectmen having authority to grant licenses for such use, or by the marshal. Such building or

structure shall always be subject to such alterations in construction and to such regulations of its use in respect to protection against fire or explosion as the department may prescribe.

SECTION 15. Gasolene or any other volatile inflammable fluid which emits a vapor at a temperature below one hundred degrees Fahrenheit when tested in the open air shall, when in any motor vehicle which is in a building or other structure, be deemed to be kept in such building or other structure within the meaning of the preceding section; provided, that this section shall not apply to any building in existence on July first, nineteen hundred and eleven, in which not more than two automobiles or motor vehicles are kept, if such building or part thereof is not used either for human habitation or for holding gatherings of more than twenty persons, or for giving entertainments, instruction or employment to more than that number.

SECTION 16. Whoever keeps, stores, uses, manufactures, sells, handles or otherwise disposes of any of the articles mentioned in section ten, in violation of section thirteen or fourteen or of any regulation, ordinance or by-law made under section ten, or whoever violates any regulation made under section fourteen, shall, except as provided in section seventeen, be punished by a fine of not more than one hundred dollars or by imprisonment for not more than one month, or both.

SECTION 17. Whoever knowingly violates or knowingly causes or permits the violation of any regulation adopted and prescribed for the transportation of gunpowder and other explosives or explosive or inflammable fluids or compounds shall be punished by a fine of not more than one thousand dollars or by imprisonment for not more than one year, or both.

SECTION 18. The supreme judicial or superior court may restrain the erection, occupation or use of a building in violation of section fourteen, or of any regulation made thereunder. (See section 1 of chapter 485 of the Acts of 1921.)

SECTION 19 (as amended by section 4 of chapter 485 of the Acts of 1921). The marshal may designate some officer of any city or town who, when so designated, may grant, in accordance with rules and regulations established by the department, the permits required by section fourteen or by the regulations made under section ten or fourteen. Such officers shall grant such permits and keep a record of them. A fee of fifty cents may be charged for any permit except as provided in section fourteen. The marshal may revoke any permit under section thirteen, or under the regulations made by authority of section ten, and such a permit may be revoked for cause by any officer who granted it.

SECTION 20. The mayor of a city, the selectmen of a town of more than fifteen hundred inhabitants, and, upon the written application of five or more citizens

of a town of less than fifteen hundred inhabitants, the selectmen thereof, shall annually appoint one or more inspectors of petroleum, who, before entering upon their official duties, shall be sworn, and who shall not be interested in the sale of crude petroleum or in the sale or manufacture of petroleum or earth rock oil or any of their products. Their compensation shall be fixed in cities by the aldermen and in towns by the selectmen and shall be paid by persons who require their services.

SECTION 21. No person shall sell or keep for sale, at wholesale or retail, for illuminating purposes, any kerosene, refined petroleum or any product of petroleum, unless it has been inspected and approved by any inspector authorized in the commonwealth. (See section 2 as amended.)

SECTION 22. Cities and towns may adopt ordinances, by-laws and regulations, consistent with law, relative to the inspection of the oils named in the preceding section which have not been inspected and approved by an inspector.

SECTION 23. Whoever violates section twenty-one or any provision of an ordinance, by-law or regulation adopted under section twenty-two, or, being an inspector appointed under section twenty, is guilty of fraud, deceit or culpable negligence in the performance of his duties, shall be punished by a fine of not more than one hundred dollars or by imprisonment for not more than one month, or both. (See Section 2 as amended.)

SECTION 24. Before the issue of a permit to use an explosive in the blasting of rock or any other substance as prescribed by the department, the applicant for the permit shall file with the clerk of the city or town where the blasting is to be done a bond running to the city or town, with sureties approved by the treasurer thereof, for such penal sum, not exceeding ten thousand dollars, as the marshal or the officer granting the permit shall determine to be necessary in order to cover the risk of damage that might ensue from the blasting; provided, that the marshal or the officer granting the permit may determine that a single and blanket bond in a penal sum not exceeding fifteen thousand dollars is sufficient to cover the risk of damage from all blasting operations of the applicant, either under the permit so issued or under future permits to use explosives in blasting operations. The bond shall be conditioned upon the payment of any loss, damage or injury resulting to persons or property by reason of the use or keeping of said explosive.

SECTION 25. Action on a bond filed under the preceding section may be brought by any persons to whom loss, damage or injury has resulted by reason of the use or keeping of said explosive, and shall be brought in the names of and for the use and at the cost and expense of such persons; but in no event shall action be brought on the bond for personal injury of an employee of the person receiving the

permit. If claims on any bond are established to an amount greater than the penal sum thereof, such claims shall be paid *pro rata* to the amount of the penal sum, and executions shall issue accordingly.

SECTION 26. The superior court shall have jurisdiction in equity, upon the petition of the Commonwealth or of a city or town, to enforce the laws of the commonwealth and the regulations of the department relative to the blasting of rock, stone or other substance without any explosive.

SECTION 27. Whoever suffers injury by the explosion of an explosive which is being kept or transported contrary to the provisions of this chapter or of the regulations of the department may recover damages therefor in tort against the persons who so violate said provisions or regulations.

METROPOLITAN FIRE PREVENTION DISTRICT

SECTION 28. The metropolitan district shall include the following cities and towns and the territory comprised in them, to wit: Arlington, Belmont, Boston, Brookline, Cambridge, Chelsea, Everett, Lynn, Malden, Medford, Melrose, Milton, Newton, Quincy, Revere, Saugus, Somerville, Waltham, Watertown, Winchester, Winthrop and Woburn, and all other cities and towns which accept sections twenty-eight to fifty-one, inclusive, or have accepted corresponding provisions of earlier laws by a two thirds vote of the city council or by the town at a town meeting. The words "heads of fire departments," as used in sections thirty-one to fifty-one, inclusive, shall mean the fire commissioner or board of fire commissioners in those cities in the metropolitan district that have such an officer or officers, the commissioner of public safety in Cambridge, the chief executive officer of the fire department of each of the other cities and towns within the metropolitan district, and the chief executive officer of the fire department of any fire district in any one or more of said cities or towns. All the provisions of sections twenty-eight to fifty-one, inclusive, shall apply to such fire districts.

SECTION 29. Such portion of the salaries of the marshal and of all persons appointed or employed under him, of the rent and office expenses, and other proper expenses and charges incurred by him in the discharge of his duties as are properly charged against the metropolitan district shall be apportioned annually by the state treasurer among the cities and towns in the metropolitan district, one half in proportion to their last annual taxable valuation and one half in proportion to the population as determined by the next preceding federal or state census. The amount so apportioned shall be added to their proportion of the state tax.

SECTION 30 (as amended by chapter 274 of the Acts of 1928¹). The marshal shall have within the metropolitan district the powers given by sections ten,

¹ See also Chapter 205, Acts of 1929.

thirteen, fourteen, twenty, twenty-one and twenty-two to license persons or premises, or to grant permits for, or to inspect or regulate, the keeping, storage, use, manufacture, sale, handling, transportation or other disposition of gunpowder, dynamite, nitroglycerine, camphine or any similar fluids or compounds, crude petroleum or any of its products, or any explosive or inflammable fluids or compounds, tablets, torpodoes, rockets, toy pistols, fireworks, firecrackers, or any other explosives, and the use of engines and furnaces as described in section one hundred and fifteen of chapter one hundred forty; provided, that the city council of a city or the selectmen of a town may disapprove the granting of such a license or permit, and upon such disapproval or upon the refusal to grant or issue the same by the officer or board designated for the purpose by the marshal under the following section, the license or permit shall in no event be granted or issued. In Boston certificates or renewal of licenses as provided in section fourteen shall be filed annually for registration with the fire commissioner, accompanied by a fee of one dollar.

SECTION 31 (as amended by section 5 of chapter 485 of the Acts of 1921). The marshal may delegate the granting and issuing of any licenses or permits authorized by sections thirty to fifty-one, inclusive, or the carrying out of any lawful rule, order or regulation of the department, or any inspection required under said sections, to the head of the fire department or to any other designated officer in any city or town in the metropolitan district. Except as otherwise provided, a fee of fifty cents may be charged for any such permit. Any such permit may be revoked by the marshal or by the officer designated to grant it.

SECTION 32 (as amended by section 2 of chapter 325 of the Acts of 1928). No volatile inflammable fluid except an amount not exceeding one quart when contained in an approved safety can and no non-volatile inflammable fluid except an amount not exceeding ten gallons for domestic use shall be kept, used or stored in any part of any building used for habitation, and no volatile inflammable fluid in quantity exceeding one gallon and no non-volatile inflammable fluid in quantity exceeding thirty gallons shall be kept, used or stored except in the tank of an automobile, motor boat or stationary engine within fifty feet of any building used for habitation, unless a permit has been obtained therefor from the marshal under such terms and conditions as he may prescribe.

SECTION 33 (as amended by section 3 of chapter 325 of the Acts of 1928). No part of any building used for habitation nor that part of any lot within fifty feet of any building so used shall, except as permitted by section thirty-two, be used for the storage, keeping or handling of any article or material that is or may become dangerous to the public safety as a fire menace unless a permit has first been obtained therefor from

the marshal. No part of any such building shall be used as a carpenter shop nor for the storage, keeping or handling of feed, hay, straw, excelsior, shavings, sawdust, cotton, paper stock, feathers or rags, except under such terms and conditions as the marshal may prescribe.

SECTION 34. The marshal or such person as he may designate may require the removal and destruction of any heap or collection of refuse or debris that in his opinion may become dangerous as a fire menace.

Neglect on the part of either the owner or occupant, or both, to remove the cause of complaint under this or the preceding section, after notice thereof has been served, shall be deemed a refusal; and the marshal or the person whom he may designate may enter upon the premises and remove such material or article and the containers thereof as may be covered by or mentioned in the notice issued. The material or articles removed, if of no substantial value, shall be destroyed; otherwise they shall be placed in storage, and the total costs attending such action shall be paid by the owner or occupant.

SECTION 35. No salamander or stove for drying plaster shall be used in any building except under such conditions as may be prescribed by the marshal; and no such salamander or stove shall be set upon a wooden floor unless it is raised above the floor at least four inches and set upon brick or other incombustible material in a bed of sand at least two inches thick spread upon the floor and covering an area of at least two feet in all directions larger than the area of the salamander or stove.

SECTION 36. Any building used in whole or in part for the business of woodworking, or for the business of manufacturing or working upon wooden, basket, rattan or cane goods or articles, or tow, shavings, excelsior, oakum, rope, twine, string, thread, bagging, paper, paper stock, cardboard, rags, cotton or linen, or cotton or linen garments or goods, or rubber, feathers, paint, grease, soap, oil, varnish, petroleum, gasoline, kerosene, benzine, naphtha or other inflammable fluids, and any building used in whole or in part for the business of keeping or storing any such goods or articles, except in such small quantities as are usual for domestic use or for use in connection with and as incident to some business other than such keeping or storing, shall, upon the order of the marshal, be equipped with automatic sprinklers; provided, that no such order shall apply to any building unless four or more persons live or are usually employed therein above the second floor.

SECTION 37. The basements of any buildings shall, upon written notice by the marshal to the owners of the buildings, be equipped with such dry pipes with outside connections as he may prescribe.

SECTION 38. Owners of buildings who, within six months after having received written notice from the marshal under section thirty-six or thirty-seven, fail

to comply with the requirement of such notice shall be punished by a fine of not more than one thousand dollars.

SECTION 39 (as amended by sections 4 and 5 of chapter 325 of the Acts of 1928). In addition to the powers given by sections thirty to thirty-eight, inclusive, the marshal may make orders and rules relating to fires, fire protection and fire hazard binding throughout the metropolitan district, or part thereof, or binding upon any person or class of persons within said district, limited, however, to the following subjects:

A. Requiring the keeping of portable fire extinguishers, buckets of water or other portable fire extinguishing devices on any premises by the occupant thereof, and prescribing the number and situation of such devices.

B. Prohibiting or regulating the accumulation and requiring the removal of combustible rubbish, including waste paper, cardboard, string, packing material, sawdust, shavings, sticks, rags, waste leather and rubber, boxes, barrels, broken furniture and other similar light or combustible refuse.

C. Prohibiting or regulating the setting or burning of fires out of doors.

D. Causing obstacles that may interfere with the means of exit to be removed from floors, halls, stairways and fire escapes.

E. Ordering the remedying of any condition found to exist in or about any building or other premises or any ship or vessel in violation of any law, ordinance, by-law, rule or order in respect to fires and the prevention of fire.

F. Causing any vessel moored to or anchored near any dock or pier to be removed and secured in some designated place, if such vessel is on fire or in danger of catching fire, or is by reason of its condition or the nature of its cargo a menace to shipping or other property.

G. Requiring and regulating fire drills in theatres, public places of amusement and public and private schools.

H. Requiring the cleaning of chimney flues and vent pipes and the installation of spark arresters in chimneys connected with permanent wood burning furnaces.

I. Requiring proper safeguard to be placed and maintained about or over roof skylights and about outer or inner courts or shafts at the roof line.

J. Prohibiting or regulating smoking in factories, workshops and mercantile establishments.

K. Requiring that all signs and advertising devices erected on buildings shall be approved by said marshal.

L. Causing to be made public all violations of fire prevention laws by posting placards on buildings or premises, and by publishing in the daily newspapers the names of the owners and specifying the buildings in which the violation occurs.

M. Defining the classes of buildings to be equipped with sprinkler protection as provided by section thirty-six.

N. Prohibiting or regulating the storage in any lot, building, shed, enclosure or other structures, of any empty wooden packing boxes, cases or barrels in a quantity occupying a space greater than two thousand cubic feet, and regulating the height of piles of lumber in lumber yards.

O. Prohibiting the thawing of water pipes by means of a torch or flame, or the fumigation of warehouses, factories or commercial buildings by the use of any volatile inflammable liquid, or any material requiring flame, without a permit from the marshal.

SECTION 40 (as amended by Section 6 of Chapter 325 of the Acts of 1928). The marshal may provide that any rule shall apply generally throughout the metropolitan district or to any specified part thereof or to any class or description of premises, which shall take effect when approved by the commissioner and the governor and council, and on such dates as they may fix.

SECTION 41. If buildings or other premises are owned by one person and occupied by another under lease or otherwise, the orders of the marshal shall apply to the occupant alone, except where the rules or orders require the making of additions to or changes in the premises themselves, such as would immediately become real estate and be the property of the owner of the premises. In such cases the rules or orders shall affect the owner and not the occupant; and unless it is otherwise agreed between the owner and the occupant, the occupant whose use of the premises has caused the making of such additions or changes, in addition to his rent or other payments, shall, after the additions or changes are made, pay a reasonable per cent of the cost thereof annually to the owner of the premises. No rule or order shall be made or enforced which requires an expenditure by the owner or occupant of more than five per cent. of the last annual assessed valuation of the land and buildings to which such rule or order relates.

SECTION 42. The marshal may require and order the heads of fire departments to investigate, observe and report to him all matters relating to fire hazard and fire prevention that he may designate, especially all violations occurring within their respective cities or towns of laws, or of ordinances, by-laws, rules or orders made by the various cities and towns, or by the marshal, relating to fires, fire hazard and fire protection.

SECTION 43. If any city or town, or any head of a fire department, or any officer, servant or agent of the commonwealth or of any city or town refuses or unreasonably neglects to obey any lawful rule, order or regulation of the marshal, such city or town, upon information presented by him, shall be liable to a fine of not more than one thousand dollars, and such head

of a fire department or other person shall be punished by a fine of not more than fifty dollars, and the rule or order may, upon application of the marshal, be enforced by the supreme judicial or superior court by writ of mandamus or otherwise. Violation or unreasonable neglect of such rules or orders by any person other than as aforesaid shall be punished by a fine of not more than ten dollars for each day during which such violation continues after notice to the person violating such rule or order. Such notice may be given by personal service or by posting the same in a conspicuous place on the premises affected thereby.

SECTION 44. The marshal or any person designated by him may enter at any reasonable hour any building or other premises or any ship or vessel to make inspection, or to enforce any law, ordinance or by-law or any rule or order of the marshal, without being guilty of trespass; provided, that there is reason to suspect the existence of circumstances dangerous to the public safety as a fire menace.

SECTION 45. The marshal shall hear and determine all appeals from the acts and decisions of the heads of fire departments and other persons acting or purporting to act under his authority, done or made or purporting to be done or made under the provisions of sections thirty to fifty-one, inclusive, and shall make all necessary and proper orders thereon. Any person aggrieved by any such action of the head of a fire department or other person may appeal to the marshal.

SECTION 46. Heads of fire departments within the metropolitan district shall investigate or cause to be investigated the cause, origin and circumstances of every fire occurring in their respective cities, towns or fire districts by which property has been destroyed or damaged, and so far as possible, determine whether the fire was the result of carelessness or design. Such investigation shall be begun immediately upon the occurrence of the fire by the head of the department in whose territory the fire occurred, or by some person designated by him; and if after making such investigation it appears to the head of the department that the fire is of suspicious origin, he shall immediately notify the marshal of the fact. Every fire occurring in the metropolitan district shall be reported in writing to the marshal within three days after the occurrence of the same by the officer in whose jurisdiction the fire occurred. Such report shall be in the form prescribed by the marshal and shall contain a statement of all facts relating to the cause and origin of the fire that can be ascertained, the extent of damage thereof, the insurance upon the property damaged, and such other information as may be required.

SECTION 47. The marshal may require every fire insurance company authorized to transact business in the metropolitan district to report to him, through the secretary or some other officer of the company designated by the board of directors, all fire losses on property insured in such company, giving the date

and location of the fire. Such report shall be mailed to the marshal within three days after loss on each fire, and the character of property destroyed or damaged and the supposed cause of the fire shall be reported within ten days after adjustment is made.

SECTION 48. The marshal shall keep in his office a record of all fires occurring in the metropolitan district and all the facts concerning the same, including statistics as to the extent of such fires and the damage caused thereby and whether such losses were covered by insurance and if so, in what amount. The record shall be made daily from the reports made by the heads of fire departments and shall be made public.

SECTION 49. The marshal shall study fire hazard and fire prevention and all matters relating thereto, hear suggestions and complaints from all persons and from all cities and towns in the metropolitan district, advise with the officers of such cities and towns, and make suggestions to the general court and to the cities and towns looking to the improvement of the laws, ordinances and by-laws relating to fire departments, construction of buildings, building or fire limits, use and occupation of buildings and other premises, protection of existing buildings, fire escapes and other life saving devices, segregation and licensing of trades dangerous by reason of fire hazard, and all other matters relating to fire prevention and fire hazard.

SECTION 50. The commissioner shall make an annual report of the acts of the division under sections thirty-one to fifty-one, inclusive, with such statistics as he may desire, and may recommend any legislation which he may deem desirable.

SECTION 51. Except as otherwise provided, any person violating any provision of sections thirty to fifty, inclusive, shall be liable to a fine of fifty dollars, or, in case of a continuing offence after notice of such violation, to a fine of not more than ten dollars for every day during which the violation continues.

GENERAL PROVISIONS

SECTION 52. No person, unless authorized by a license or permit duly issued as required by this chapter, shall have in his possession or under his control any bombs or explosives.

Whoever violates any provision of this section shall be punished by a fine of not more than three hundred dollars or by imprisonment for not more than one year, or both, and any bomb or explosive owned by him or found in his possession or under his control shall be forfeited to the commonwealth. Any officer qualified to serve criminal process may arrest without a warrant any person violating this section.

SECTION 53. Notice of the seizure of any bomb or explosive owned by or found in the possession or under the control of any person violating the preceding section shall be sent to the marshal by the officer making the seizure immediately after the guilt of such person

is established by a final adjudication in any prosecution brought against him for the said violation and thereupon the bomb or explosive so seized shall be delivered to the marshal and destroyed or sold at his discretion, and he shall pay any proceeds to the commonwealth.

SECTION 54. (as amended by chapter 104 of the Act of 1921). No person shall construct, maintain or use any tank or container of more than ten thousand gallons capacity, unless constructed principally of wood, for the storage of any fluid other than water, unless the same is underground, without first securing a permit therefor from the commissioner. Whoever violates this section or a rule or regulation made under the following section shall be punished by a fine of not less than fifty nor more than one thousand dollars.

SECTION 55. The department shall make rules and regulations governing the construction, use and maintenance of tanks to which the preceding section applies. Such rules and regulations shall not take effect until approved by the governor and council, and filed in the office of the state secretary.

SECTION 56. Whoever manufactures or sells or knowingly uses, or has in possession for the purpose of sale, any golf ball containing any acid, fluid, gas or other substance tending to cause the ball to explode and to inflict bodily injury shall for the first offence be punished by a fine of not more than five hundred dollars, and for any subsequent offence by a fine of not more than one thousand dollars or by imprisonment for not more than one year, or both.

SECTION 57 (as amended by chapter 500 of the Acts of 1921, by chapter 80 of the Acts of 1924 and by chapter 95 of the Acts of 1925). No person shall sell or keep for sale any blank cartridge, toy, pistol, toy gun or toy cannon that can be used to fire a blank cartridge; or sell or keep for sale, or fire, explode or cause to explode any blank cartridge or bomb, or sell or keep for sale, or set off, explode or cause to explode any fireworks containing any picric acid or picrates, or any firecracker exceeding two inches in length and three eighths of an inch in diameter or of a greater explosive power than a fire cracker of such size containing black gun powder only; provided that this section shall not apply to illuminating fireworks set off between the hours of seven o'clock in the afternoon and twelve o'clock midnight, excepting those containing picric acid or picrates, or the sale of any article herein named to be shipped directly out of the commonwealth, or to the sale or use of explosives in the firing of salutes by official authorities, or to the sale or use of blank cartridges for a duly licensed show or theatre or for signal purposes in athletic sports, or to experiments at a factory for explosives, or to the firing of salutes with cannon on shore or on boats where a permit has been secured from the marshal or some officer designated by him therefor, or to the sale

of blank cartridges for the use of, or their use by, militia or any organization of war veterans or other organization authorized by law to parade in public a color guard armed with fire arms, or in teaching the use of fire arms by experts on days other than holidays.

SECTION 57a. No person shall store fireworks in wholesale lots outside the premises of a fireworks manufactory in any building or other structure located within one thousand feet of any church, theatre, hall, place of public assembly, factory or any inhabited building, nor shall any person manufacture fireworks, unless the said person has previously filed with the clerk of the city or town in which the said fireworks are to be manufactured or stored, a bond running to the treasurer of the said city or town with a surety or sureties approved by the said treasurer, in such penal sum, not less than ten thousand dollars, as the mayor of the city or the selectmen of the town, with the approval of the state fire marshal, shall determine to be necessary to cover the losses, damages or injuries that might ensue from the said manufacture or wholesale storage. The bond shall be conditioned upon the payment of any judgment obtained in an action against said person so manufacturing fireworks or storing fireworks in wholesale lots for or on account of any loss, damage or injury resulting to persons or property by reason of the said manufacture or wholesale storage of the said fireworks; provided that said judgment was obtained in an action brought within a period of twelve months following the date when said loss, damage or injury is alleged to have occurred.

SECTION 57b. Action on a bond filed under the provisions of the preceding section may be brought by any person or persons holding such judgment and may be brought in the name of the treasurer of said city or town but for the use and benefit and at the cost and expense of such person or persons so bringing said action.

SECTION 57c. No person engaged in the business of displaying or exhibiting fireworks shall, by himself or his agents, discharge, fire off, explode or display fireworks at any public exhibition or exhibitions thereof unless he has on file with the state treasurer a bond running to the state treasurer with a surety or sureties approved by him for the penal sum of fifteen thousand dollars, and for such additional penal sum as the state fire marshal shall determine to be necessary to cover the losses, damages or injuries that might ensue to persons or property by reason of said public exhibition or exhibitions. The bond shall be conditioned upon the payment of any judgment obtained in an action brought against said person so discharging, firing off, exploding or displaying fireworks at any public exhibition or exhibitions thereof, for or on account of any loss, damage or injury resulting to persons or property by reason of the said discharging, firing off, exploding or displaying of said fireworks at said public exhibition

or exhibitions; provided that said judgment was obtained in an action brought within a period of twelve months following the date of the public exhibition at which the cause of said action is alleged to have occurred.

SECTION 57*d*. Action on a bond filed under the provisions of the preceding section may be brought by any person or persons holding such judgment and may be brought by such person or persons in the name of the state treasurer but for the benefit and use and at the cost and expense of such person or persons so bringing the said action.

SECTION 57*e*. No action for injury to an employee of a person manufacturing, wholesale storing or publicly exhibiting fireworks shall be brought on a bond given under section fifty-seven *a* or fifty-seven *c* if such injury arises out of and in the course of the employment. If claims under any bond filed under either of said sections are established to an amount greater than the penal sum of the bond, such claim shall be paid *pro rata* to the amount of the penal sum and executions shall issue accordingly. Nothing in the four preceding sections shall deprive a person suffering loss, damage or injury or any other right or remedy provided by law.

SECTION 57*f*. Firecrackers and pyrotechnical ship or railway signals shall be included and classified as fireworks but the provisions of the five preceding sections shall not apply to the storage of pyrotechnical ship or railway signals, nor to the discharge, firing or exploding of the said signals when used for the protection of life and property.

SECTION 57*g*. Whoever violates any provisions of the six preceding sections shall be punished by a fine of not more than five hundred dollars or by imprisonment for not more than six months, or both.

SECTION 58 (as amended by section 7 of chapter 325 of the Acts of 1928). No person shall manufacture, store, keep for sale, sell or transport any compound for use as a stove polish containing any liquid or compound whatsoever which will emit a gas that will flash at a temperature of less than one hundred and forty degrees Fahrenheit, except that foundry paste which contains inflammable compound, if packed in metal containers, sealed by fusion and weighing in gross not less than five pounds, and if such container is labelled "Dangerous — Inflammable Compound — Keep away from fire, heat and light" may be manufactured, stored, kept for sale, sold or transported for use only by stove foundries, stove manufacturers and stove dealers on their own premises under regulations prescribed by the marshal. The flash point of said compound shall be ascertained by the use of either Abel-Pensky's or Pensky-Martens' closed cup instrument, or by some other method approved by the marshal.

SECTION 59. Violation of any provision of section fifty-seven or fifty-eight shall be punished by a fine of not more than one hundred dollars or by imprisonment for not more than one month, or both.

SECTION 60 (as amended by section 2 of chapter 336 of the Acts of 1925). Whoever mixes for sale naphtha and illuminating oils or naphtha and oils to be used for fuel in dwellings or other buildings whereby human life is endangered or exposed, or sells or offers for sale such mixture, or sells or offers for sale, except for remanufacture, illuminating or fuel oils made from coal or petroleum which will evaporate a gas that will flash at a temperature of less than one hundred and fifteen degrees Fahrenheit or ignite at a temperature of less than one hundred and twenty-five degrees Fahrenheit, to be ascertained by the application of Tagliabue's or some other approved instrument, shall be punished by a fine of not more than one hundred dollars or by imprisonment for not more than one month, or both, and shall also be liable for any damage suffered by any person from the explosion or ignition of such oil thus unlawfully sold or kept or offered for sale. Such oil thus unlawfully sold or kept or offered for sale, and the casks or packages containing the same shall be forfeited and sold, and the proceeds shall be equally divided between the informer and the commonwealth.

SECTION 61 (as amended by section 3 of chapter 336 of the Acts of 1925.) For the purposes of the preceding section, illuminating or fuel oils made from coal or petroleum and having an igniting point of less than one hundred and twenty-five degrees Fahrenheit, to be determined as therein provided, shall be deemed to be mixed with naphtha, and shall be branded unsafe for illuminating purposes or for use as fuel.

SECTION 62 (as amended by section 6 of chapter 485 of the Acts of 1921). Whoever sells, or keeps or offers for sale naphtha under a name which tends to conceal its inflammable character shall be punished by a fine of not more than one hundred dollars or by imprisonment for not more than one month, or both, and shall be subject to the liability set forth in section sixty.

SECTION 63. Upon complaint made to a court or justice authorized to issue warrants in criminal cases that the complainant has probable cause to suspect, and does suspect that gunpowder, dynamite or any other explosives, crude petroleum or any of its products, or explosive or inflammable fluids are kept or are to be found in any place contrary to this chapter or regulations made hereunder, such court or justice may issue a search warrant in conformity with chapter two hundred and seventy-six, so far as applicable, commanding the officer to whom the warrant is directed to enter any shop, building, manufactory, vehicle or vessel specified in the warrant, and there make diligent search for the articles specified in the warrant,

and make return of his doings forthwith to the court of justice having jurisdiction thereof. Warrants issued for crude petroleum or any of its products or explosive or inflammable fluids may be directed to an inspector appointed under section twenty, to an engineer of a fire department or to a fireward.

SECTION 64. Articles seized under the preceding section may, after due notice and hearing, be adjudged to be forfeited, and may be ordered to be sold or destroyed in such manner as the court or magistrate may direct, and the proceeds, if any, paid into the county treasury.

SECTION 65. Whoever keeps matches for sale or use in any store unless the same are in unbroken cases or in a metal or other fireproof receptacle with the cover closed, except when it is necessary to obtain access thereto, shall be punished by a fine of not more than fifty dollars.

SECTION 66 (as amended by section 7 of chapter 485 of the Acts of 1921). Whoever liberates or flies a fire balloon shall be punished by a fine of not more than one hundred dollars or by imprisonment for not more than one month, or both.

APPENDIX 15

DIGEST OF LAWS RELATIVE TO FIRE PREVENTION AND FIRE PROTECTION

A. GENERAL LAWS OF MASSACHUSETTS AS CODIFIED
1920, INCLUDING SUBSEQUENT AMENDMENTS
THROUGH 1928**Chapter 21.— Department of Conservation.**

Section 5 provides for a state fire warden to look after the control of forest fires.

Chapter 22.— Department of Public Safety.

The commissioner is the executive and administrative head. The department is divided into a Division of State Police, a Division of Inspection and a Division of Fire Prevention. The Division of Fire Prevention is under the charge and direction of the State Fire Marshal.

The State Fire Marshal is appointed by the governor with the advice and consent of the council for a term of three years and at a salary not exceeding \$4,000.

Provides for appointment of a board of boiler rules and a board of elevator regulations.

Chapter 30.— State Departments, Commissions, Offices and Employees.

Section 37 provides procedure for the issuance of technical regulations authorized by law.

Chapter 31.— Civil Service.

This chapter embraces fire department personnel, provides for admission and promotion by examinations (except in case of fire commissioner) and preference of veterans above all other applicants. Provides for removal or demotion only for cause after a hearing. (Rules issued under this chapter limit applicants for Boston Fire Department to the ages 22-35 years.)

Chapter 40.— Powers and Duties of Cities and Towns.

Authorizes zoning in cities other than Boston.

Chapter 48.— Fires.

This chapter covers the various details necessary to authorize the establishment of fire departments and to provide the necessary legal sanction for their operation. The most elementary form of fire department authorized is the appointment of fire wards who may be appointed whether or not they have any fire apparatus with which to fight fires. Where a city or town has some fire apparatus the selectmen may appoint enginemen and provide for a permanent fire force and their compensation.

Towns are also authorized to establish fire departments and the method of appointing the chief is described. Cities or towns are also permitted to

organize a Board of Fire Engineers which when so organized can run the fire department. The Board may make certain regulations with regard to fire hazards.

Where it is desired to establish a fire department in a district which includes the areas of more than one city or town a provision is made for the establishment of a fire district in which a fire department can be duly organized.

The chapter also provides for the appointment of forest wardens and contains details on the control of forest fire hazards. It provides for the tenure of office of chiefs of fire departments in the Metropolitan Fire Prevention District, authorizes cities or towns to adopt the 2-platoon system, provides for the standardization of hose couplings throughout the state and for firemen's relief.

Chapter 66.— Public Records.

Sections 11 and 12 provide for fire protection for public records, and obliges the officers in charge of a state department, county commissioners, city councils and selectmen to maintain fireproof rooms, safes or vaults for the keeping of public records.

Chapter 89.— Law of the Road.

Sections 6a-7a provide right of way for fire apparatus, but restricts said right of way to the going to a fire and not upon its return.

Provides that no person shall drive over any hose unless so directed by a member of the department, nor within three hundred feet of a fire apparatus going to a fire or responding to an alarm, nor to park or leave an automobile unattended within six hundred feet of a fire, or within fire lines established.

Chapter 90.— Motor Vehicles.

Section 1 takes fire engines and apparatus out of the classification of motor vehicles subject to the law.

Chapter 92.— Metropolitan Water District.

It provides for the construction, maintenance and operation of a system of metropolitan water works for Arlington, Belmont, Boston, Chelsea, Everett, Lexington, Malden, Milton, Medford, Melrose, Nahant, Newton, Quincy, Revere, Somerville, Stoneham, Swampscott, Watertown and Winthrop, and other towns within ten miles of the State House.

A commission is organized to control this water system and apportion its cost over the communities supplied. The State Board of Health is to supervise the system to prevent pollution.

Chapter 123. Commitment and Care of Insane and Other Mental Defectives.

Provides for a monthly fire drill and inspection of fire apparatus in State Hospitals.

Chapter 139.— Common Nuisances.

Provides for the demolition of burnt or dangerous buildings.

Chapter 140.— Licenses.

Provides for fire escapes, fire extinguishers and fire alarms in public lodging houses.

Provides for licensing operators of certain furnaces and steam engines.

Chapter 141.— Supervision of Electricians.

Provides for the supervision of electricians.

Chapter 143.— Inspection of Buildings, etc.

Provides for the inspection of certain buildings in the state. Many of its provisions do not apply to Boston. Provides an elementary building code for cities and towns which have none. Covers matters of egress facilities from factories, halls, theaters, schoolhouses, lodging houses, etc.

Provides for inspection of elevators and cinematographs.

Chapter 144.— Tenement Houses in Cities Other Than Boston.

A code applying to cities in the state, but not to Boston.

Chapter 145.— Tenement Houses in Towns.

Another code of laws applying only in towns of the state.

Chapter 146.— Inspection of Boilers.

Outlines the work of the division of inspections of the Department of Public Safety. Provides a Board of Boiler Rules and the inspection of boilers, air tanks and ammonia compressors. Provides for a Board of Elevator Regulations. Provides for licensing and examining of steam engineers, firemen and elevator operators.

Chapter 147.— State and Other Police.

Outlines the work of the State Police (division of the Department of Public Safety).

Chapter 148.— Fire Prevention.

This chapter provides for the work of the State Fire Marshal. It establishes the Metropolitan Fire Pre-

vention District. Certain sections apply to the state as a whole, while others apply only to the Metropolitan District.

Most of the authority for fire prevention work is in the state given concurrently to the fire marshal and the local head of the fire department. In the Metropolitan District the authority is apparently primarily with the marshal, who is empowered to delegate it to the heads of the fire departments in the district. It is not entirely clear, however, as to who in the Metropolitan District has the primary jurisdiction when such a delegation of power has been made.

In any part of the state the marshal is empowered to pass on appeals from the decisions of local fire chiefs.

The marshal is authorized to make regulations on practically all fire hazards to apply within or without the Metropolitan District as he sees fit. In addition to regulations on fire hazards, the marshal is empowered to make regulations on certain tanks, sign boards and other things which have nothing to do whatever with fire hazard. In addition to regulations, the marshal may make rules or orders in specific cases.

In general, the marshal has excellent authority to supervise fire prevention work throughout the state, especially to encourage local enforcement.

A considerable portion of the chapter is taken up with detailed provisions on fireworks, explosives and numerous minor fire hazards, much of which might better be covered by regulations.

Chapter 149.— Labor and Industries.

Section 130 prohibits storing explosives or flammables in factories so as to obstruct means of egress.

Chapter 160.— Railroads.

Fire regulations for railroad property. Applies to details of heating and lighting cars, locomotive boilers, spark arrestors, clearing of right of way, etc.

Chapter 165.— Water and Aqueduct Companies.

Applies to water supplies other than the metropolitan supply in metropolitan Boston.

Chapter 166.— Lines for Transmitting Electricity.

This regulates lines for transmitting electricity.

Chapter 266.— Crimes against Property.

Covers the arson laws and burning to defraud.

Chapter 272.— Miscellaneous Crimes.

Safeguards from fire are established for the stabling of horses and mules.

Chapter 276.— Search Warrants, Rewards, etc.

Provides rewards for apprehending felons.

B. SPECIAL ACTS**Chapter 307 of the Acts of 1917.**

Calls for resubmission at this time (1917) of all regulations issued to that date, to Secretary of State.

Boston Building Code.

Chapter 550 of the Acts of 1907 as amended since.

Also 42 special acts containing subject matter that should be incorporated in the code itself as in its present detached form it is very hard to follow.

Fifteen chapters of the General Laws as codified in 1920 also apply to Boston and are enforced so far as they apply by the Building Commissioner.

Chapter 18 of the Statutes Relating to the City of Boston (1908).

Establishes the Fire Commissioner as executive head of the Fire Department.

Chapter 39 of the Statutes Relating to the City of Boston (1908).

Provides for the operation of the fire and protective departments.

Electrical Law and Code.

Various special acts relating to Boston, authorize the fire commissioner to supervise wires of all kinds.

Boston Zoning Law.

Chapter 488, Acts of 1924, as amended Chapter 137, Acts of 1928.

APPENDIX 16

ORGANIZATION PLAN FOR A FIRE PREVENTION COMMITTEE

DIVISIONS OF THE COMMITTEE

1. Sub-committee on Public Fire Protection.
2. Sub-committee on Laws and Ordinances.
3. Sub-committee on Structural Improvements.
4. Sub-committee on Educational Activities.

SCOPE OF THE WORK OF THE DIFFERENT SUB-COMMITTEES

Sub-committee on Public Fire Protection.

NOTE.—Preliminary to undertaking a survey of the public fire protection of the community the committee should secure a copy of the engineering survey prepared by the National Board of Fire Underwriters or the local rating organization. This survey will indicate the essential improvements considered necessary by competent fire prevention engineers.

1. To make a study of the needs of the fire department to determine whether the personnel and apparatus are sufficient in quantity and quality to cope with fire conditions in the community.

2. To secure the proper training and drill of the personnel of the fire department through an adequate and properly conducted drill school.

NOTE.—If there is no drill school, it is wise to send the chief or some assistant, properly selected, to a satisfactory drill school elsewhere before attempting to organize a local school.

3. To secure an adequate regular inspection of all mercantile, industrial, and public buildings, both through the regular firemen and through fire prevention bureau properly organized and with adequate authority behind it.

4. To investigate the reliability and adequacy of the fire alarm telegraph system.

5. To investigate the possibilities of adequate well-directed salvage operations on the part of the fire department, with a view to reducing to a minimum losses from water, exposure, etc.

6. To investigate the handling and prosecution of incendiary fires, with a view to securing the cooperation of the police department and other agencies in eliminating arson.

7. To study the water supply from a fire protection standpoint. Such a survey should include a checkup of the distribution system, number and location of hydrants, size of mains, pressure, etc.

8. To secure the standardization of hose couplings to national standard so as to make possible the exchange of fire department service with adjoining cities if emergency arises.

9. To make a study of traffic conditions to insure the rapid response of apparatus to alarms in any section.

Sub-committee on Laws and Ordinances.

1. To make a thorough study of the local laws and ordinances on fire prevention and protection in comparison with the approved standards. This study should include the building code, the electrical code, the laws or ordinances on inspection of buildings, control of hazardous materials and fluids, construction of chimneys, roof coverings, exits, handling and use of motion picture film, etc.

2. To secure the passage of approved ordinances for better fire protection and prevention.

NOTE.—The importance of the work of this committee will require the counsel, advice and support of all members in order to develop and maintain proper conditions.

Sub-committee on Structural Improvements.

1. To make a study of the conflagration hazard of the city, with a view to abolishing this hazard through elimination or proper protection of sub-standard buildings.

NOTE.—The engineering survey prepared by the National Board of Fire Underwriters or the local rating organization will indicate the conflagration areas and serve as a basis for this work.

2. To encourage the protection of vertical and horizontal building openings and the installation of automatic sprinklers and other private fire protection appliances.

3. To make a study of the exit facilities and possible life hazard of buildings in which people congregate.

4. To make a survey of all schools, churches, hospitals, theaters, and other public buildings, with a view to removing fire and life hazards.

Sub-committee on Educational Activities.

1. SCHOOLS.

(a) To arrange for the teaching of fire prevention in the schools. In this connection the preparation of a carefully planned course of instruction is important. At least half an hour every two weeks should be devoted to the subject.

(b) To provide home inspection blanks which may be distributed to all the pupils.

(c) To stimulate interest in fire prevention in the schools through talks by firemen, essay contests, plays, etc.

2. FIRE PREVENTION WEEK.

To arrange for a comprehensive Fire Prevention Week program, which will serve to arouse the interest of the entire community in fire prevention work and which will assist the committee in gaining attention to their various activities.

3. CLEAN-UP WEEK.

To organize and carry through a clean-up campaign in the spring.

4. THE PRESS.

To supply local papers with regular fire prevention material such as is issued by the Chamber of Commerce of the United States, to secure special newspaper publicity on local fire prevention work, local fire hazards, etc.

5. CLUBS.

To arrange for regular fire prevention programs for all of the various civic clubs.

6. GENERAL PUBLICITY.

To maintain a constant fire prevention educational campaign through the use of the radio, posters, and all other mediums of gaining public attention.

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